



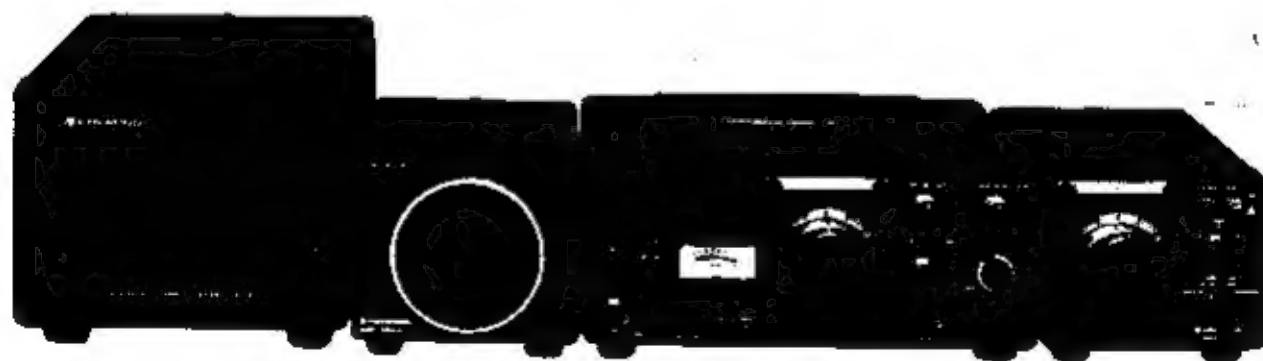
KENWOOD

SERVICE MANUAL

**Model TS-120S
VFO-120 SP-120
PS-30 AT-120**

TS-120V

**INCLUDES SCHEMATIC ONLY FOR
THIS VERSION OF THE TS-120S**



HF SSB TRANSCEIVER

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SPECIFICATIONS/SPECIAL COMPONENTS DATA

Frequency Range:

80 m band	3.5~4.0 MHz
40 m band	7.0~7.3 MHz
20 m band	14.0 ~ 14.35 MHz
15 m band	21.0 ~ 21.45 MHz
10 m band A	28.0 ~ 28.5 MHz
10 m band B	28.5 ~ 29.0 MHz
10 m band C	29.0 ~ 29.5 MHz
10 m band D	29.5 ~ 29.7 MHz
WWV	15.0 MHz (receive only)

Mode: SSB (A3J), CW (A1)

Power Requirements:

80 m ~	
15 m band	200W PEP for SSB operation 160W DC for CW operation
10 m band	160W PEP for SSB operation 140W PEP for CW operation

Antenna Impedance: 50Ω

Carrier Suppression: Carrier better than 40 dB down from the output signal

Sideband Suppression: Unwanted sideband is better than 50 dB down from the output signal

Mic. Impedance: 500Ω ~ 50kΩ

Audio Frequency

Response: 400 ~ 2600 Hz (−6 dB)

Harmonic Radiation: Better than 40 dB down from output signal

Receiver Sensitivity: 0.25μV for S/N 10 dB or better

Image Ratio: image frequency better than 50 dB down from the output signal

IF Rejection:

IF frequency is 70 dB or more down from the output signal.

Frequency Stability:

Within 100 Hz during any 30 minute period after warm up.
Within ±1 kHz during the first hour after 1 minute of warm up.

Selectivity:

SSB, CW 2.4 kHz (−6 dB)
4.2 kHz (−60 dB)

AF Output:

More than 1.5W (8Ω load, 10% distortion)

AF Load Impedance:

4 ~ 16Ω for both speaker and headphone.

Power Supply:

12 ~ 16V DC (13.8V)

Power Consumption:

Less than 18A in transmit (less than 1.5 SWR ratio)

(at DC 13.8V):

Less than 0.7A in receive

Semiconductors and Tube:

IC's	26
FET's	16
Transistors	90
Diodes	142
Display Tube	1

Dimensions:

W 241(241) × H 94(108)
× D 235(281) mm
(With Projection)

Weight:

Approx. 5.6 kg (12.3 lbs)

NOTE:

The circuit and ratings may change without notice due to development in technology

SPECIAL COMPONENTS DATA

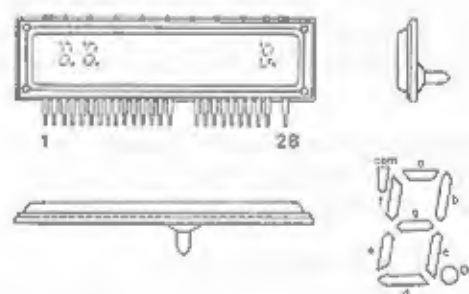
- Application
2SC2290 (HF power amplifier) (V03-2290-06)
NPN Epitaxial planar transistor Si
- Absolute maximum ratings

Item	Pc	V _{CE0}	V _{CEs}	V _{CEo}	I _C	I _E	T _{stg}
Value	175 (W) (T _C =25°C)	45 (V)	45 (V)	4.0 (V)	20 (A) ~ 20 (A)	−65 ~ 175 (°C)	

- Application
2SC2509 (HF power amplifier) (V03-2509-06)
NPN Epitaxial planar transistor Si
- Absolute maximum ratings

Item	Pc	V _{CE0}	V _{CEs}	V _{CEo}	V _{CEo}	I _C	I _E	T _{stg}
Value	20 (W) (T _C =25°C)	40 (V)	40 (V)	18 (V)	4 (V)	5 (A) ~ 5 (A)	−55 ~ 150 (°C)	

- Indicating tube 9-BT-12 (V40-7760-86)



PIN NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CONNECTION	F	Nc	Gr	Nc	Nc	Gr	q	f	Gr	w	q	Gr	Nc	Nc
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	Gr	Nc	Nc	Gr	Gr	z	b	Gr	q	com	Gr	Np	F	

FEATURES/GENERAL INFORMATION/YK-88C

FEATURES

1. SINGLE CONVERSION SYSTEM USING PLL CIRCUITRY

The single conversion system, with a unique PLL Phase Locked Loop circuit, FET balanced mixers and MOS FET'S assures excellent spurious and intermodulation characteristics.

2. BUILT-IN DIGITAL DISPLAY

The digital display affords easy reading of operating frequency to an accuracy of 100 Hz, on any band and any mode.

3. BUILT-IN SHIFT CIRCUIT (Passband Tuning)

An IF SHIFT system is built in to the transceiver to allow shifting of the IF passband, thereby eliminating adjacent channel interference.

4. 3.5~29.7 MHz AND WWV BANDS

The transceiver is designed to operate on LSB/USB/CW in the 3.5~29.7 MHz bands. WWV (14.5~15 MHz) is also built in to the transceiver to permit accurate frequency calibration.

5. COMPACT, LIGHT-WEIGHT DESIGN

The TS-120 has many advanced features, yet it is compact and light-weight and suitable for mobile and field operation, as well as fixed station operation.

6. EASY OPERATION

All controls and switches are carefully arranged for ease of operation, ensuring convenience and versatility.

7. ALL SOLID-STATE DESIGN

The all solid-state, compact unit features a wide band final stage, eliminating the need for peaking controls.

8. FOUR FIXED CHANNELS

Four FIX channels can be installed, one for each of the 7, 14, 21 and 28 MHz bands. The 3.5 MHz and 28 MHz fixed xtal position can be exchanged by simply moving a connector on the AF-GEN unit.

9. FULL RANGE OF AUXILIARY FUNCTIONS

The TS-120 is equipped with VOX, balanced gate noise blanker and a 25 kHz marker.

10. OPTIONAL CW FILTER YK-88C

The TS-120 permits use of the optional YK-88C CW filter. CW semi-break-in operation is provided using the built-in VOX and CW side tone circuits.

11. WIDE VARIETY OF OPTIONAL ACCESSORIES

The following optional accessories are available: Regulated Power Supply (PS-30), Mobile Mount (MB-100), CW Filter (YK-88C), External VFO (VFO-120), External Speaker (SP-120), and antenna tuner AT-120.

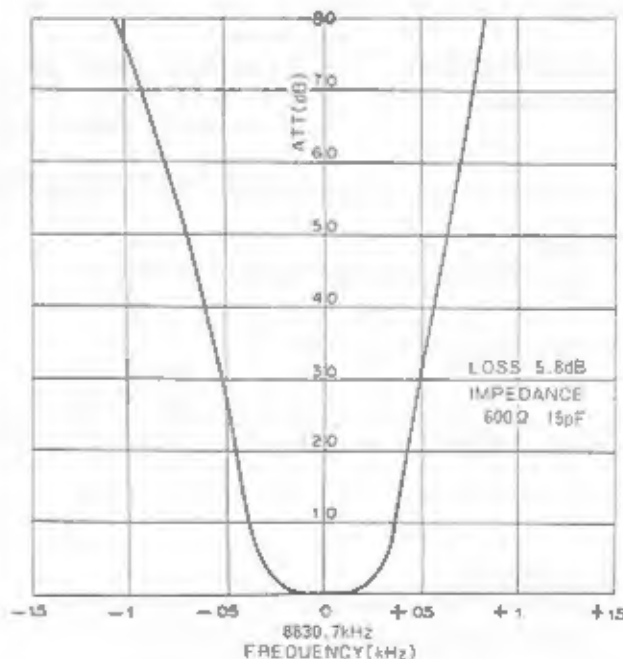
GENERAL INFORMATION

Page 49 shows a block diagram of the TS-120 HF Amateur transceiver. It employs a single-conversion system with PLL circuitry. The IF is 8.83 MHz.

The TS-120 features a number of unique circuits and overall high performance. It is designed so the PLL lock frequency of each band, the CAL marker signal, and the counter clock circuit use a single reference frequency crystal instead of individual crystals as found in the TS-820 series transceiver. Circuits include IF SHIFT, VOX (with semi-break-in CW), side tone, noise blanker (NB), and crystal calibrator (CAL) for convenient and versatile transceive operation.

YK-88C SPECIFICATIONS

Center frequency:	8830.7 kHz
Center frequency deviation:	Less than ± 150 Hz (6 dB)
Passband width:	500 Hz -6 dB
Attenuation band width:	1.5 kHz $(-60$ dB)
Ripple:	Less than 2 dB
Minimum loss:	6 dB ± 2 dB
Guaranteed attenuation:	Less than ± 2 kHz $\sim \pm 1$ MHz More than 80 dB
Terminal impedance:	600 $\Omega \pm 5\%$, 15pF $\pm 5\%$



YK-88C filter attenuation characteristic

CIRCUIT DESCRIPTION

RECEIVING CIRCUIT

The signal from the antenna is fed to the 8.83 MHz IF trap circuit. This signal is stepped up about 10 dB and impedance converted by a wide-band transformer before it is applied to the bandpass filter (BPF). The BPF is common to transmission and reception, eliminates the need for a preselector, and makes the RF section compact in design. The signal from the BPF is fed to the dual-gate MOS FET wideband RF amplifiers consisting of a 3SK74 (Q1) and a 2SC1815 (Q2), where the 2 MHz to 35 MHz signal is amplified about 20 dB.

The RF amplifier output passes through a wide-band transformer to the input balanced transformer of the balanced mixer (two 3SK74s, Q3 and Q4), where it is mixed with the VCO output from the PLL and converted to the 8.83 MHz IF. This signal is applied to the IF unit, through the ceramic filters, NB gate circuit and the crystal filter. The NB circuit is controlled by the NB switch on the front panel. The signal, passing through the crystal filter, is amplified about 90 dB by the three-stage 3SK74 MOS FET IF amplifier (Q1, Q2, and Q3) and is demodulated into audio by the four-diode ring detector.

From the final IF stage, the signal also passes through a buffer amplifier and is fed to the AGC circuit where it is detected and amplified. Receiver gain is controlled by this AGC voltage applied to the second gates of the RF and IF amplifiers, with the time constant determined by R38 (2.2 M Ω) and C40 (1 μ F). Input levels of 2 dB and 34 dB are indicated as S1 and S9 on the S-meter. The AF signal is amplified by Q1, a 2SC2240 (GR), gain controlled, and further amplified by an HA1366W (Q7), the power-amplifier IC, to drive the speaker. This signal, which is transistor coupled with Q14, a 2SC1815(Y), and Q15, a 2SA1016(Y), is sampled for ANTI-VOX control, so the VOX circuit is not tripped by the speaker output. This new system is a departure from the conventional transformer coupled sampling systems.

TRANSMITTING CIRCUIT

The microphone signal is amplified by transistors Q18, a 2SC2240(GR), Q10 and Q11, each a 2SC1815(Y), and is fed to the four-diode balanced modulator (BM) circuit. Microphone impedance is 500 Ω to 50k Ω .

The 8.83 MHz DSB signal from the BM is amplified about 10 dB by Q12, a 2SK19 FET, and is fed to the IF unit where the unwanted sideband is removed by the crystal filter to produce an SSB signal. The gate of Q12 is also controlled by the protection voltage which is developed when the transmitter output looks into an incorrect load, continuously reducing output power. The SSB signal from the crystal filter is amplified about 30 dB by the 3SK74 IF amplifier (Q1), and is fed to the transmit 3SK74 MOS FET balanced mixer (Q5 and Q6), where it is mixed with the VCO output and converted to the final transmit frequency.

Unwanted spurious components are eliminated by the transmit/receive BPF circuit, and the signal is wideband-amplified by Q7, Q8 (2SC1815), and Q9 (2SC2086).

In the final unit the signal is amplified by the 2SC2075 driver (Q1) and by the 2SC2509 push-pull power amplifiers (Q2 and Q3). Then the signal is amplified by the 2SC2290 push-pull power amplifiers (Q4, 5). The signal then passes through an RF filter and is fed to the antenna.

Antenna output is toroid-sampled to detect the forward and reflected power. The forward power is used for ALC and the reflected power for protection. Forward power is fed to the second gate of the 3SK74 transmit/receive IF amplifier (Q1), with a time constant determined by R4 (1.5 M Ω) and C25 (0.47 μ F). For CW operation, block bias keying controls the base circuit of the 2SA1015 switching transistor (Q10) in the RF circuit. Q10 controls the first and second gate voltages of the transmit mixer (Q5 and Q6) and the base voltage of the predriver (Q9).

FUNCTIONAL DESCRIPTION

TS-120S FREQUENCY SYSTEM

The TS-120S employs single conversion with a unique PLL circuit, as shown in Fig. 1.

The frequency system is basically that of the TS-820 with the exception of the PLL circuit.

PLL CIRCUIT

VCO output is obtained by synthesizing the 10 MHz and 500 kHz reference, from the counter, and the VFO and CAR instead of a separate HET crystal circuit for each band the TS-120 uses the counter reference oscillator, and a programmable divider circuit contained in the PLL. This simplifies circuit design and eliminates changes in transmit/receive frequency due to HET crystal frequency differences. Fig. 2 shows PLL circuit construction and Table 1 shows the frequency in each circuit.

Referring to Fig. 1, MIX (3) combines CAR and VFO signals and is operated straight through to mixer (1) on 3.5 and 7 MHz. MIX (2) operates at 14 MHz and above with the output of MIX (3) to provide mixer (1) input, as shown in

Table 1. MIX (1) output is filtered, amplified, shaped and divided by the programmable divider to obtain 500 kHz output.

The programmable divider converts the information from the band switch into a BCD signal in the counter. By presetting, the signal is divided at the ratio shown in Table 1. The phase comparator is a Motorola MC4044P. The loop filter amplifier, component transistors, minimizes unwanted spurious signal. If output of the phase comparator unlocks for any reason, VCO output is switched off to prevent out of band emission and, simultaneously the digital display blanks.

CAR OSCILLATOR

The CAR oscillator contains one oscillator and two crystals for LSB, USB, and CW operation. The oscillator frequency in each mode is listed in Fig. 1.

Oscillator frequency can be varied by the IF SHIFT control during reception.

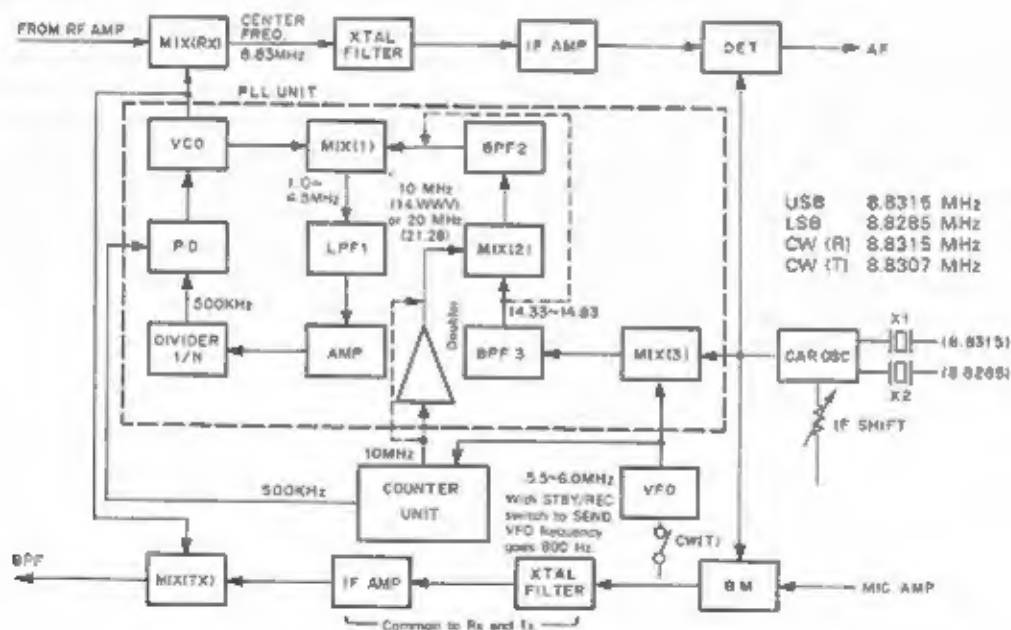


Fig. 1 TS-120 Frequency configuration

FUNCTIONAL DESCRIPTION

Band	RX, TX Frequency	VCO	MIX(1) Input	MIX(1) Output	Divider	D C B A
WWV	14.5 ~15.0	23.33 ~23.83	24.33 ~24.83	1.0	1/2	1 1 1 0
3.5	3.5 ~4.0	12.33 ~12.83	14.33 ~14.83	2.0	1/4	1 1 0 0
7	7.0 ~7.5	15.83 ~16.33	14.33 ~14.83	1.5	1/3	1 1 0 1
14	14.0 ~14.5	22.83 ~23.33	24.33 ~24.83	1.5	1/3	1 1 0 1
21	21.0 ~21.5	29.83 ~30.33	34.33 ~34.83	4.5	1/9	0 1 1 1
28	28.0 ~28.5	36.83 ~37.33	34.33 ~34.83	2.5	1/5	1 0 1 1
28.5	28.5 ~29.0	37.33 ~37.83	34.33 ~34.83	3.0	1/6	1 0 1 0
29	29.0 ~29.5	37.83 ~38.33	34.33 ~34.83	3.5	1/7	1 0 0 1
29.5	29.5 ~30.0	38.33 ~38.83	34.33 ~34.83	4.0	1/8	1 0 0 0

Table 1 The frequency chart

VFO OSCILLATOR

The TS-120 VFO oscillator has been developed on the basis of the TS-820 and TS-520 VFO. It is physically smaller and its operating frequency has been raised to cover 5.5 to 6.0 MHz.

During CW operation, transmit frequency is shifted approx. 800 Hz above the receive frequency. CW shift is also digitally displayed.

The main tuning dial covers 25 kHz per revolution and is calibrated at 1 kHz intervals. A 10 kHz subscale is also provided. The operating frequency can be read easily from either the analog or digital display.

DIGITAL COUNTER

The TS-120 digital counter employs a VFO frequency counting system as shown in Fig. 3.

The VFO frequency is mixed with a 5 MHz signal obtained from the reference oscillator chain by a 3SK73 (Q7) and is converted to a 1 MHz signal. This signal passes through the LPF, is amplified, buffered and shaped into a square wave, passes through the 0.1 second gate circuit and is applied to the four-digit counter. The signal is counted from 10 Hz to 100 kHz and fed to the preset counter deriving the carrier output.

The 100 kHz order digit presets "5" or "0" to display the operating frequency.

The 1 MHz and 10 MHz order digits are composed by diode matrix operating on bandswitch information.

The counter outputs are switched by the multiplexer and are converted from BCD to seven-segment information by the decoder to light the fluorescent display tube.

The 10 MHz signal from the time-base reference oscillator is divided to produce gate, latch, and reset pulses which are fed to the counter. The 10 MHz and 500 kHz signals are fed to the PLL circuit.

The marker circuit produces a 100 kHz signal which synchronizes the 25 kHz multivibrator to obtain a marker signal as accurate as the reference frequency. The analog dial can be accurately calibrated to the marker signal.

The 1/10 division at the first-stage count-down chain uses low-power Schottky TTL while the remaining divisions are made by a CMOS IC for low power consumption and minimum spurious emission.

Because of the IF SHIFT circuit, the CAR frequency is independent of the transmit/receive frequency. Once the VFO

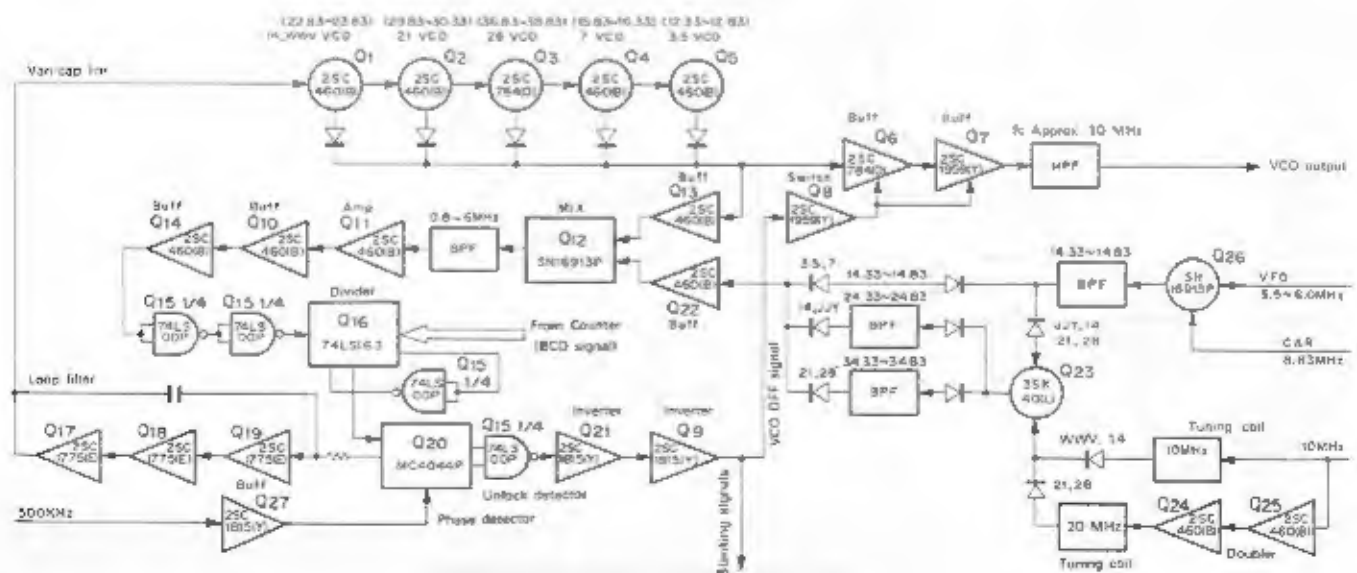


Fig. 2 TS-120 PLL circuit configuration

FUNCTIONAL DESCRIPTION

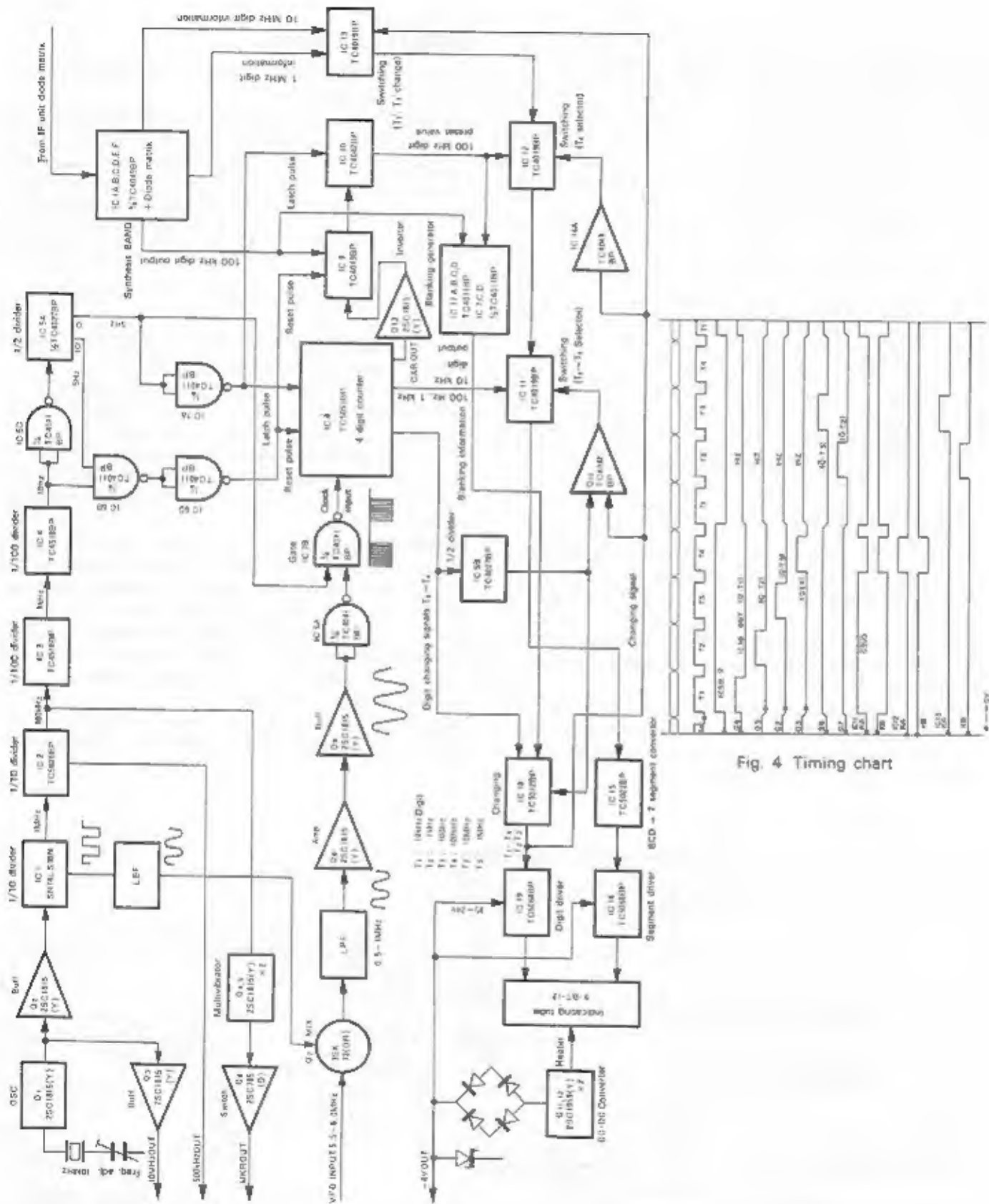


Fig. 4 Timing chart

Fig. 3 TS-120 Counter circuit configuration

FUNCTIONAL DESCRIPTION

frequency is counted, the operating frequency is indicated as accurately as the 10 MHz reference oscillator frequency is calibrated to WWV. Operating frequency is indicated accurate to the 100 Hz order, regardless of the band or mode. If the VFO output varies (beyond the band edge the 1 and 10 MHz digits disappear and a blanking signal is developed.

Operating band	Blanking frequencies
3.5 MHz	more than 4 000.0 MHz
7.0 MHz	less than 7 000.0 MHz
14.0 MHz	less than 14 000.0 MHz
21.0 MHz	less than 21 000.0 MHz
28.0 MHz	less than 28 000.0 MHz
29.5 MHz	more than 29 000.0 MHz
29.0 MHz	less than 29 000.0 MHz
29.5 MHz	more than 30 000.0 MHz

PROTECTION CIRCUIT

Fig. 5 shows the TS-120 protection circuit. When the transmit output load varies, the toroid in the final circuit samples reflected power. It is then rectified and amplified, producing a protection voltage to control the 2SK19 (Q12) on the AF-GEN unit, so transmitter output is continuously reduced.

FILTER UNIT

1. ALC: Protection circuit (VSWR)

The protection voltage picked up by L18 in the filter unit is amplified by Q1 (2SC1815), then applied to the ALC line to control the output voltage.

The ALC voltage is amplified by Q3 (2SC1815). For the 28 MHz band, the output power is lowered to 50W by applying BAND information to the B terminal so that Q2 controls the emitter voltage of Q3. For mobile operation, the power output is lowered to 50W in all bands by grounding the PO terminal of the filter unit so that the power down circuit for 28 MHz band is operated.

2. Fan drive circuit

The output of the thermistor detecting the temperature of the final unit is applied to Q6 (2SA562) via Q7 and Q8, so that Q6 is switched to operate the fan. The fan starts to rotate at about 45°C although the operating range shown in specification is 30~60°C. It stops when the temperature drops to a level 5~15°C lower the start temperature. This circuit operates regardless of transmission or reception because it detects the temperature of the heat sink.

3. AVR circuit

The 11V AVR consists of Q4, Q5 and Q6. The regulated voltage is supplied to every unit except for the fan drive circuit during transmission. The fan drive circuit is always supplied with the regulated voltage regardless of transmission or reception.

4. Filter circuit

The filter is a 2 stage constant K filter (3-stage for 3.5 MHz band).

FINAL UNIT

1. Temperature protection

1. Core temperature protection operates when the output transformer temperature exceeds 120°C.

2. Operates when the heat sink temperature exceeds 90°C because of some defect.

When either of the above protection systems operate, the RL circuit in the AF GEN unit is turned OFF and the unit is forcibly placed in the reception mode and transmission is inhibited. The protection circuit automatically recovers when the temperature drops to the normal level (13), the temperature drops by about 40°C).

2. Temperature detection by the fan drive circuit

The heat sink temperature is detected by the thermistor TH3 to control fan operation.

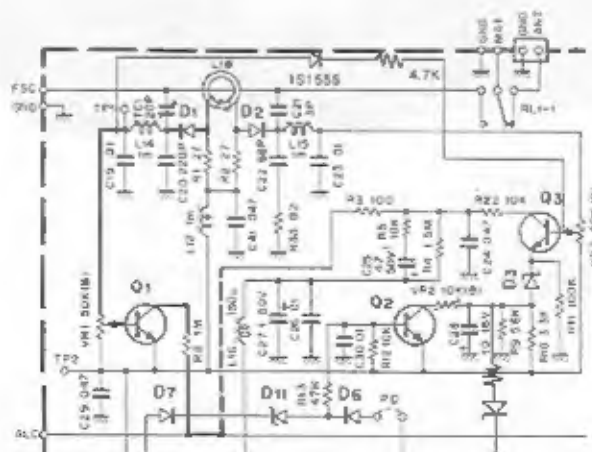
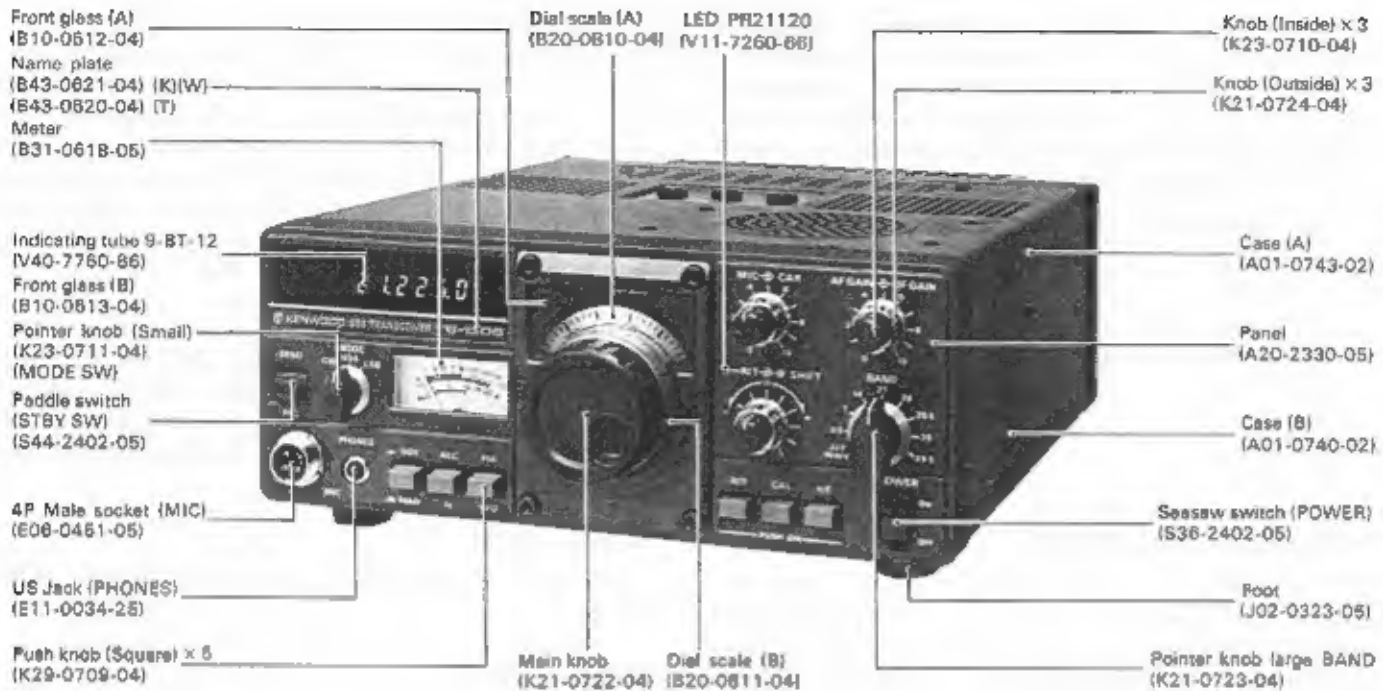


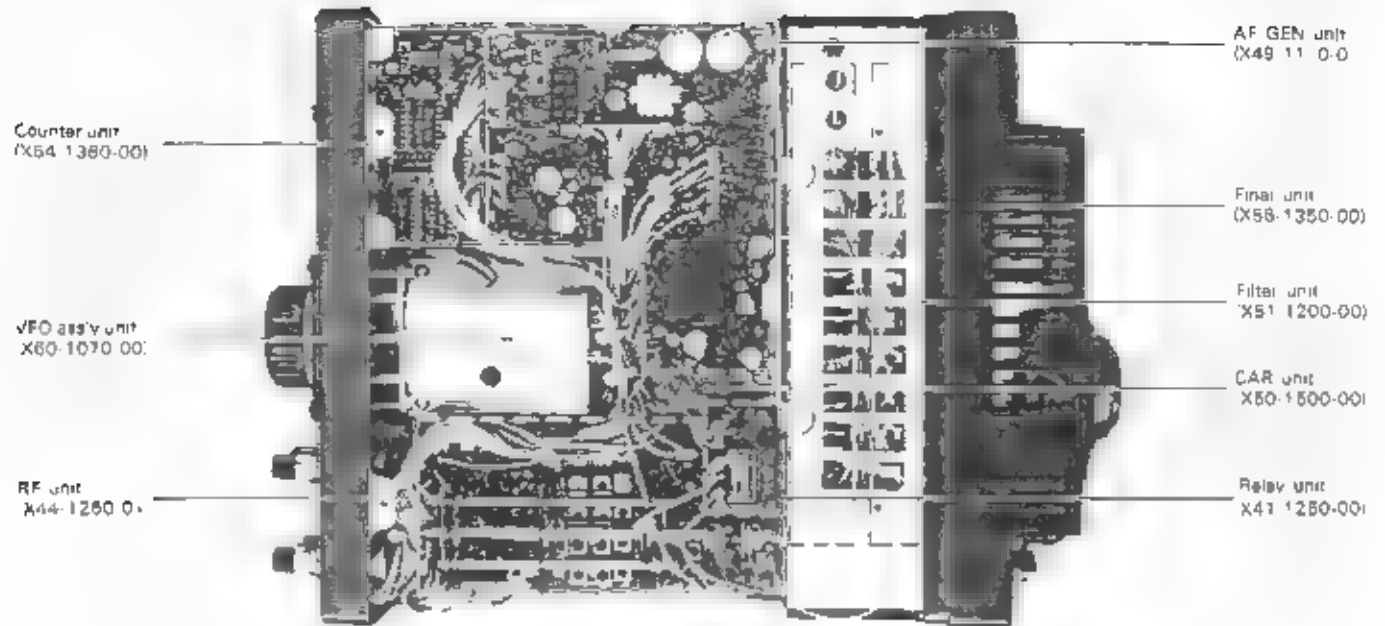
Fig. 5 TS120 Protection circuit

OUTSIDE VIEWS

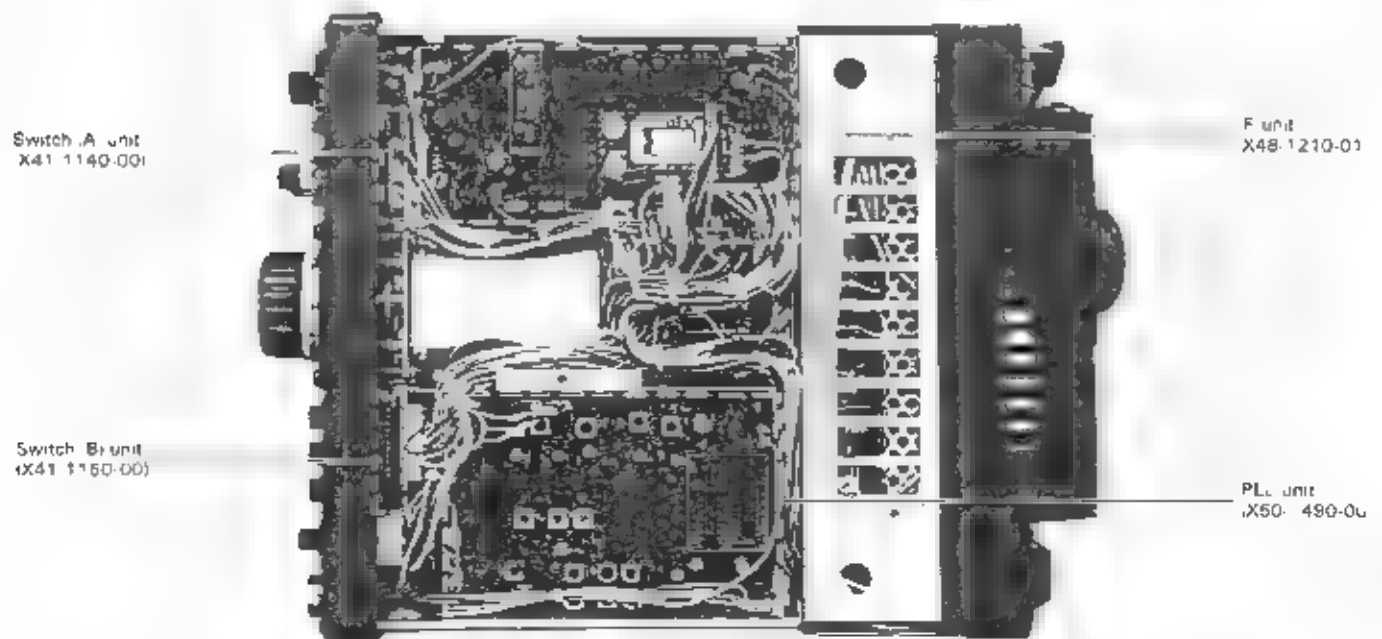


INSIDE VIEWS

TOP VIEW

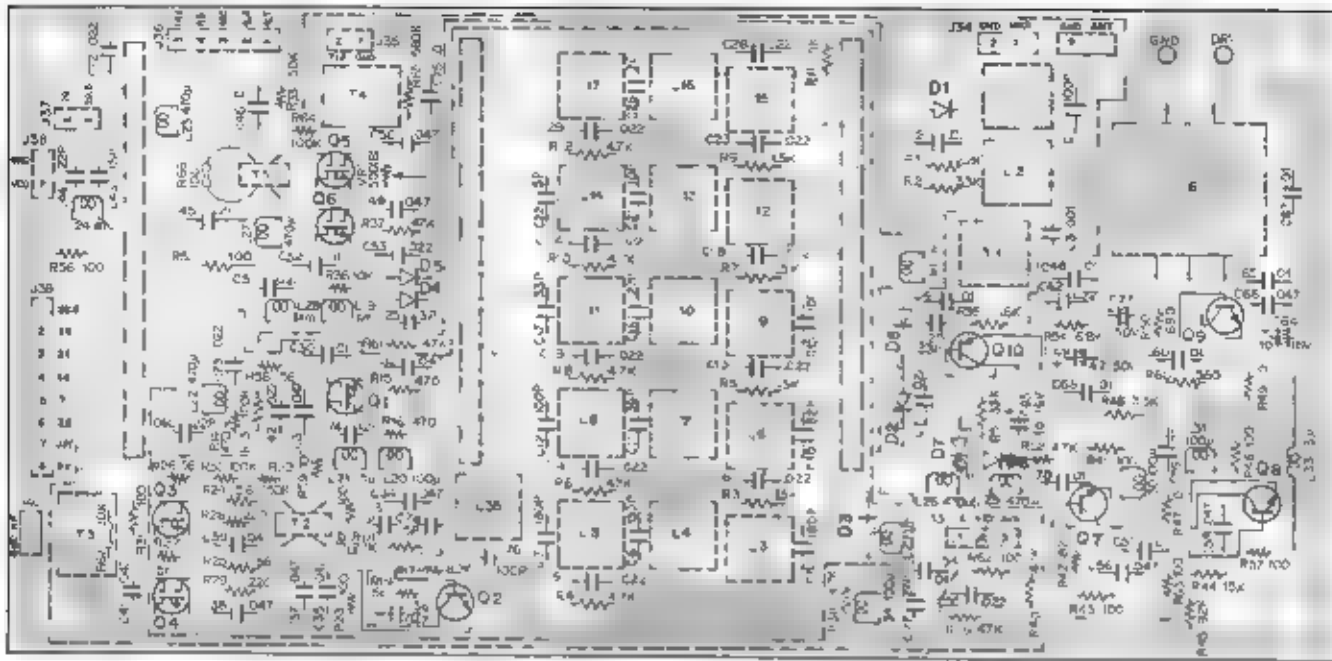


BOTTOM VIEW



PC BOARD VIEWS

▼ RF UNIT (X44-1260-01)

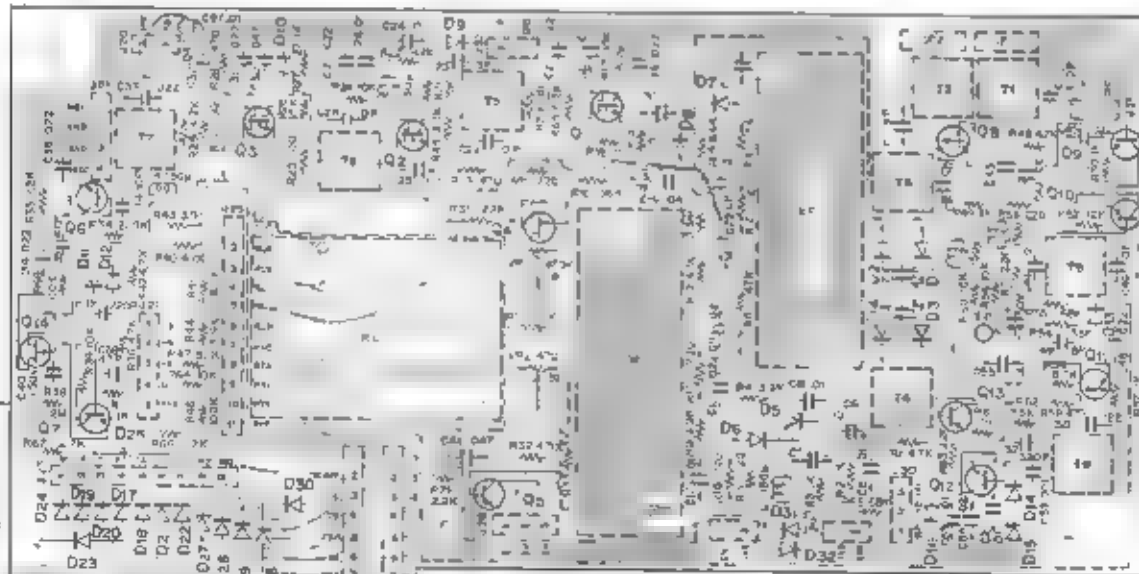


Q1,3~6 3SK74(L), Q2,7,9 2SC1815(Y), Q9 2SC2086, Q10 2SA1015(Y)
D1,3,5 1S1587, D2,4 1S2589, D6,7 1S1555



2SC2086 2SA1015(Y) 2SC460(B) 2SK19(Y) 2SK30A(O) 3SK74(L)
2SC1815(Y) 2SK19(GR)

▼ IF UNIT (X48-1210-01)



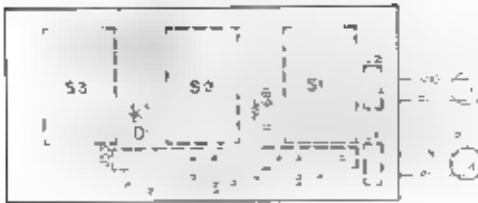
D1~4,6,8 1S1587
D5,7 1S1007
D9,10,13, 17~32 1S1555
D11,12,14,15 1N60
D16 MV13

S3 NO SW
SWITCH & UNIT

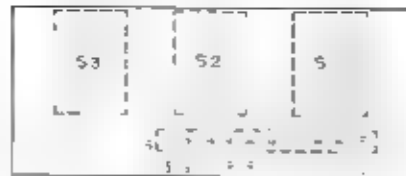
Q1~3 3SK74(L), Q4 2SK19(Y)
Q5 2SC1815(GR)
Q6,7,12,13 2SC1815(Y)
Q8 2SK19(GR)
Q9~11 2SC460(B), Q14 2SK30A(O)

PC BOARD VIEWS

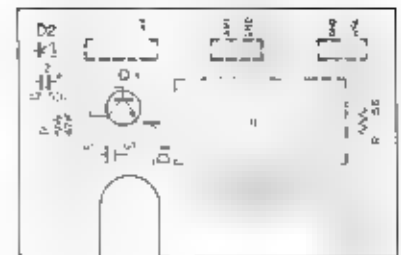
▼ SWITCH (B) UNIT
(X41-1150-00)



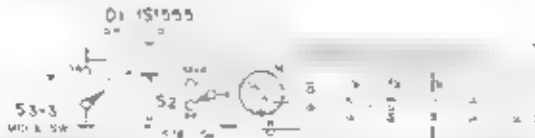
▼ SWITCH (A) UNIT
(X41 1140-00)



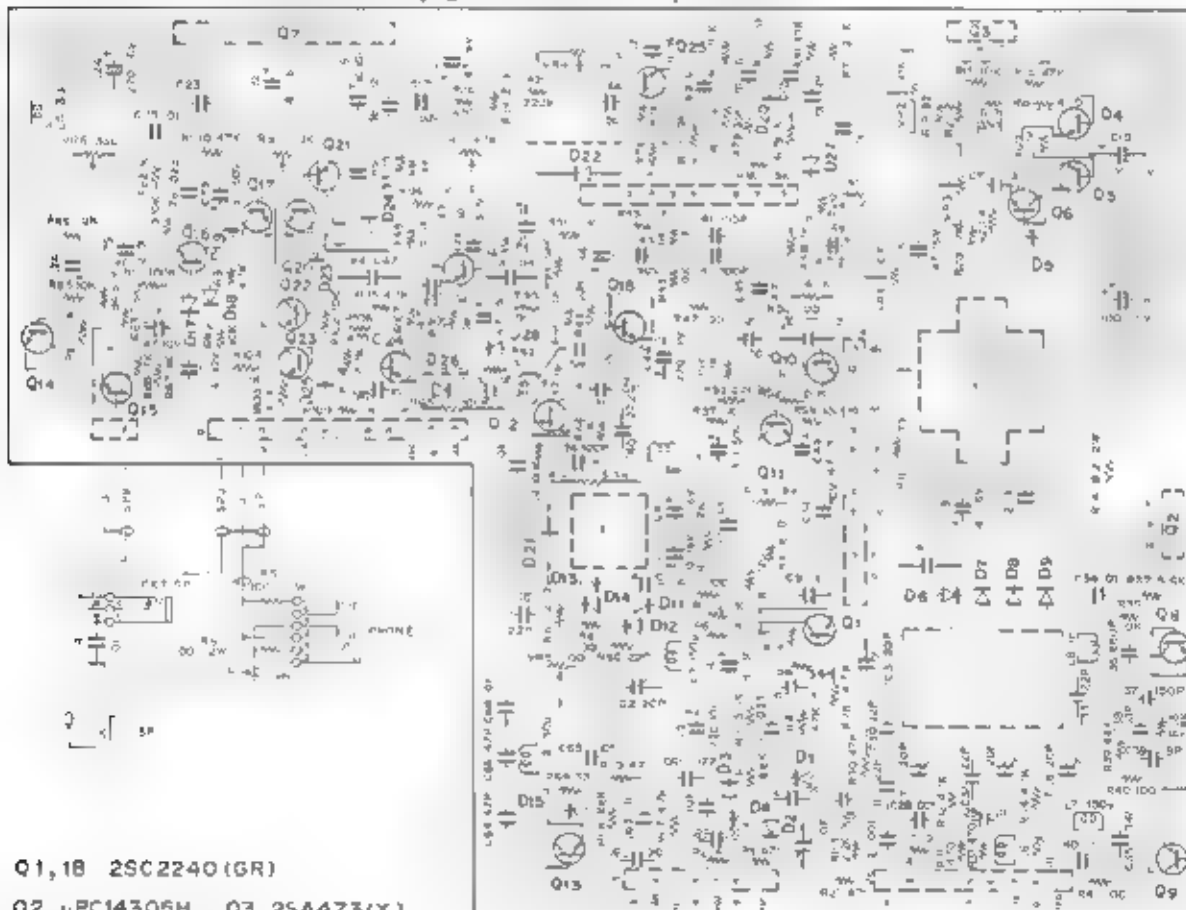
RELAY UNIT
(X41 1250-00)



▼ AF, GEN UNIT (X49-1110-00)



Q1 2SC1959(Y) D1,2 1S1555



Q1,18 2SC2240(GR)

Q2 μ PC14305H, Q3 2SA473(Y)

Q4~6,10,11,14,16,17,19,20,23,25 2SC1815(Y), Q7 HA1366W, Q8,13 2SC460(B), Q9 2SC1959 Y

Q12 2SK19(GR), Q15,21 2SA1015(Y), Q22 2SC1815(GR), Q24 2SA562(Y)

D1~4,11~14,23,24,26 1N60, D5 WZ-061, D6~9 1S2588, D15 1S1587, D17~22,25,27,28 1S1555



2SA1015(Y) 2SC1959(Y)
2SC1815(Y) 2SC2240(GR)
2SC1815(GR)



2SK19(GR)



2SA473(Y)



2SA562(Y)



2SC460(B)



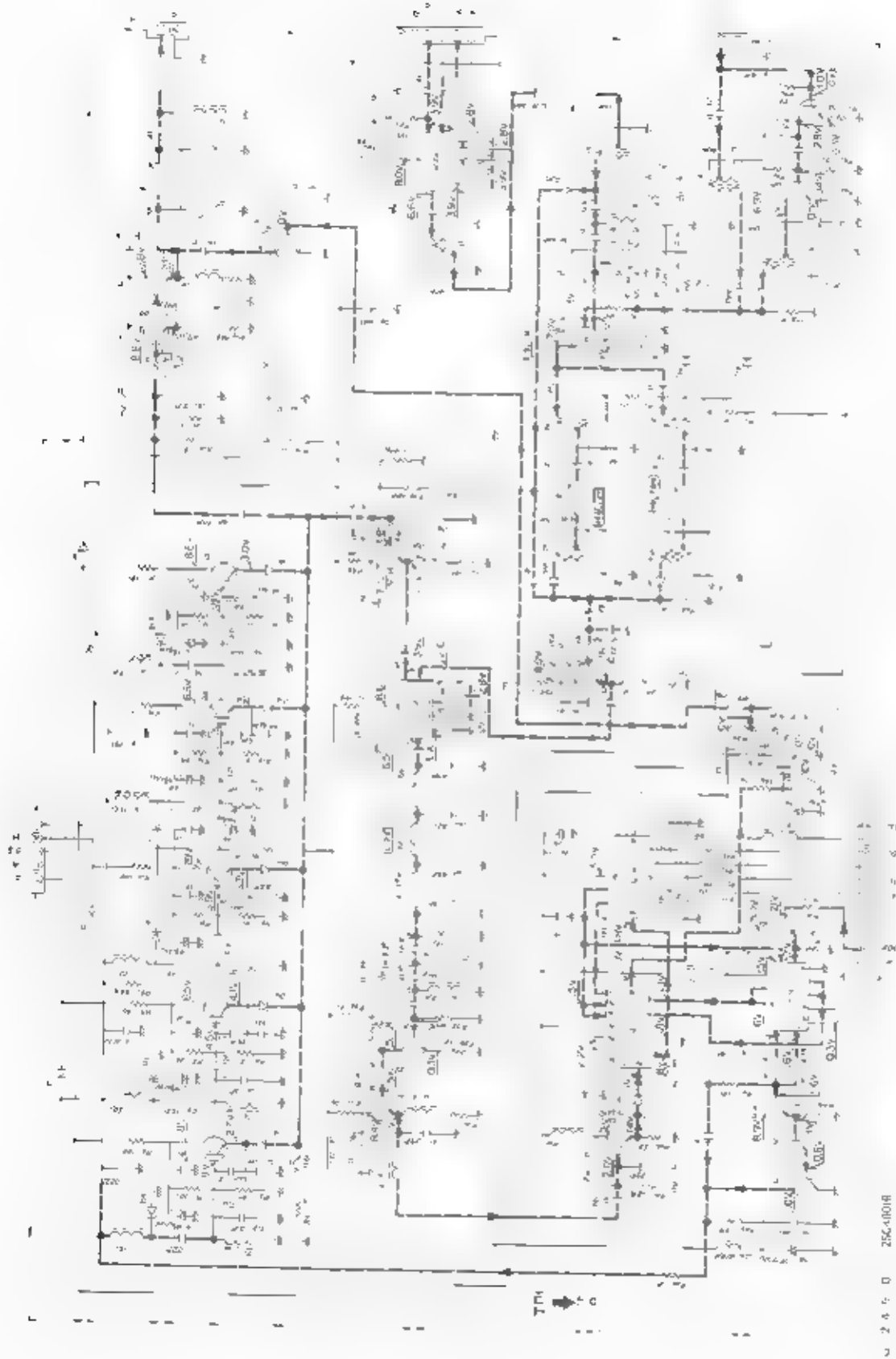
μ PC14305H



HA1366W

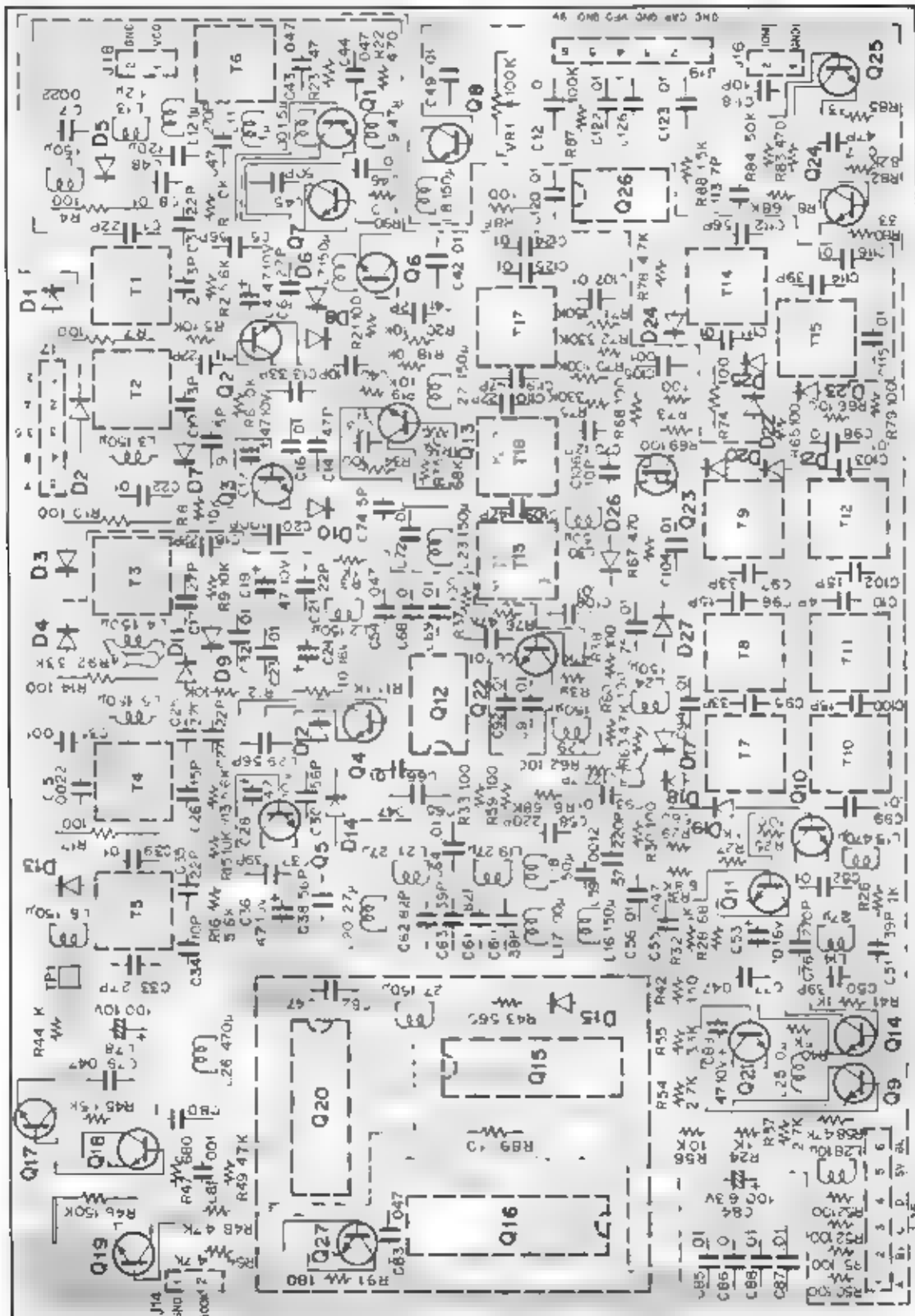
CIRCUIT DIAGRAM

▼ PLL UNIT (X50-1490-00)



PC BOARD VIEWS

▼ PLL UNIT (X50-1490-00)



25T461 B

25A5624Y
25C784 O

35K40 L

25C1775 E
25C18 S Y
25C889 Y

HD74L9165N

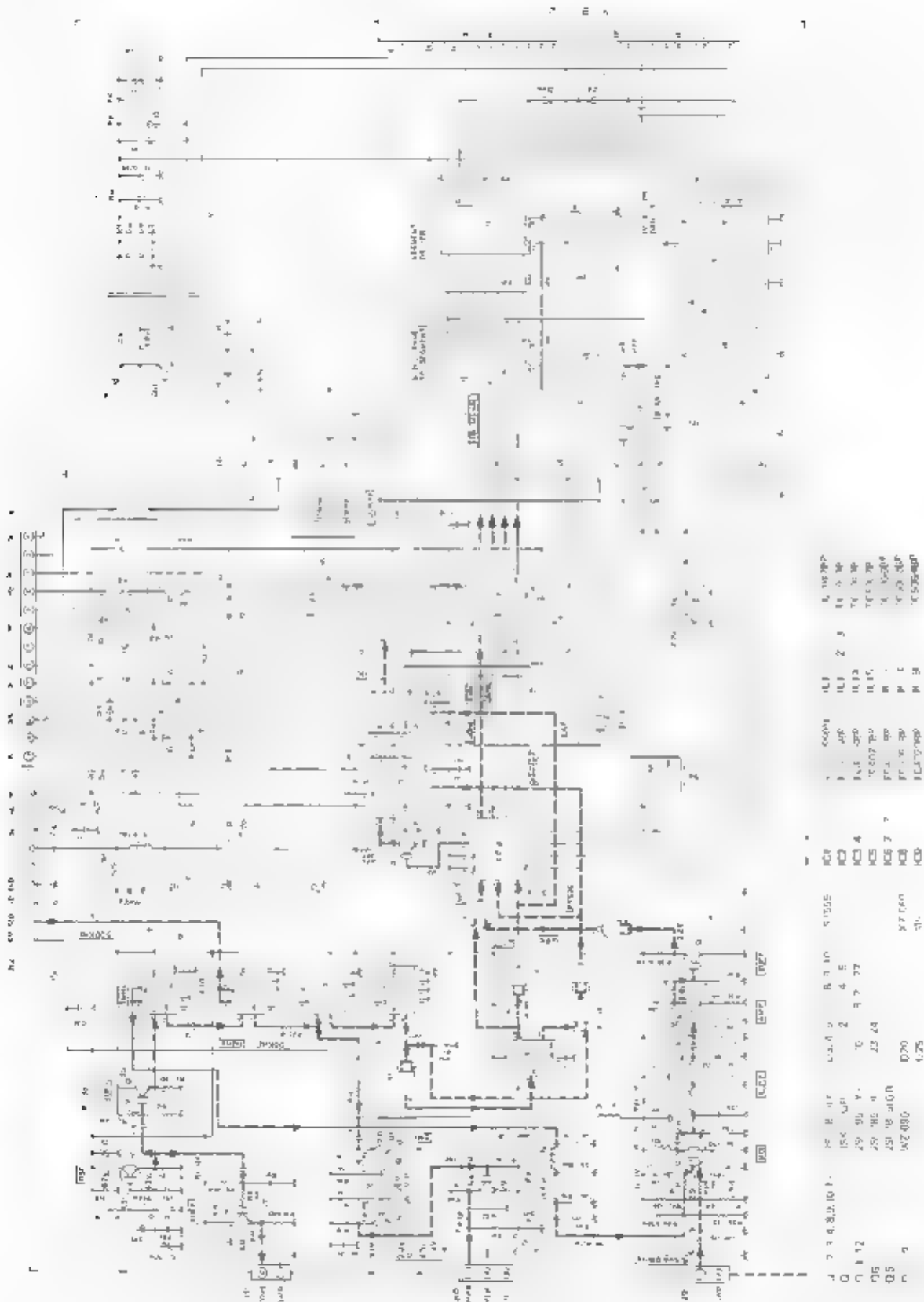
HD74L500P
MC4044P

5N189 3P

5N3 40 V EWS

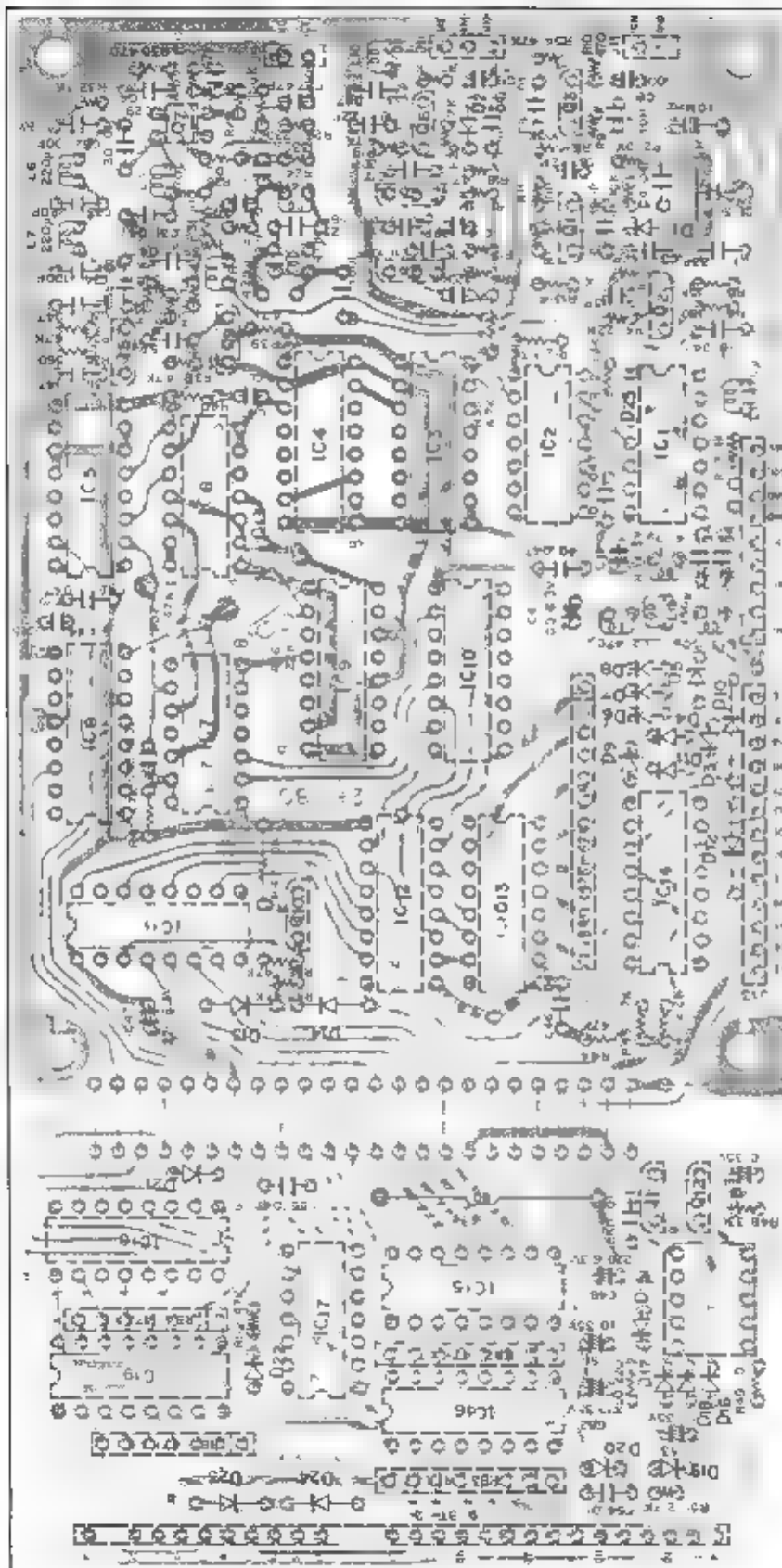
CIRCUIT DIAGRAM

▼ COUNTER UNIT (X54-1360.00)



PC BOARD VIEWS

▼ COUNTER UNIT (X54-1360-00)



2SC785(O) 2SC1815(GR)
2SC1815(Y) 2SC1959(Y)



2SK73(GR)



TC4018BP TC5012BP
TC4027BP TC5022BP
TC4029BP TC5051BP
TC4042BP TC5064BP
TC4049BP TC5066BP
TC4518BP



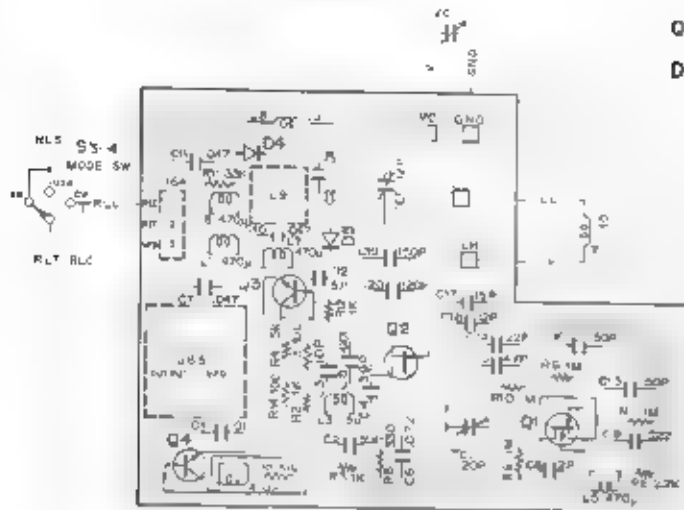
SN74LS90N TC5026BP
TC4011BP



TOP VIEWS

PC BOARD VIEWS

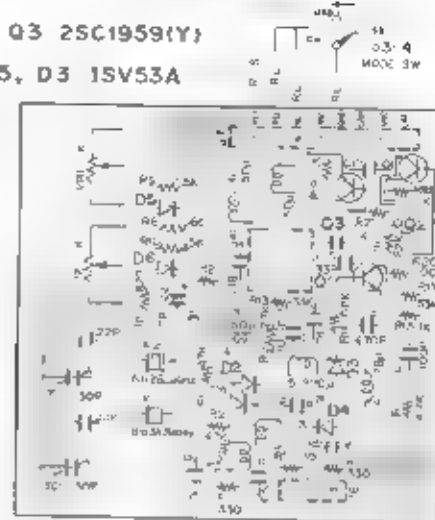
▼ VFO UNIT (X40-1130-00)



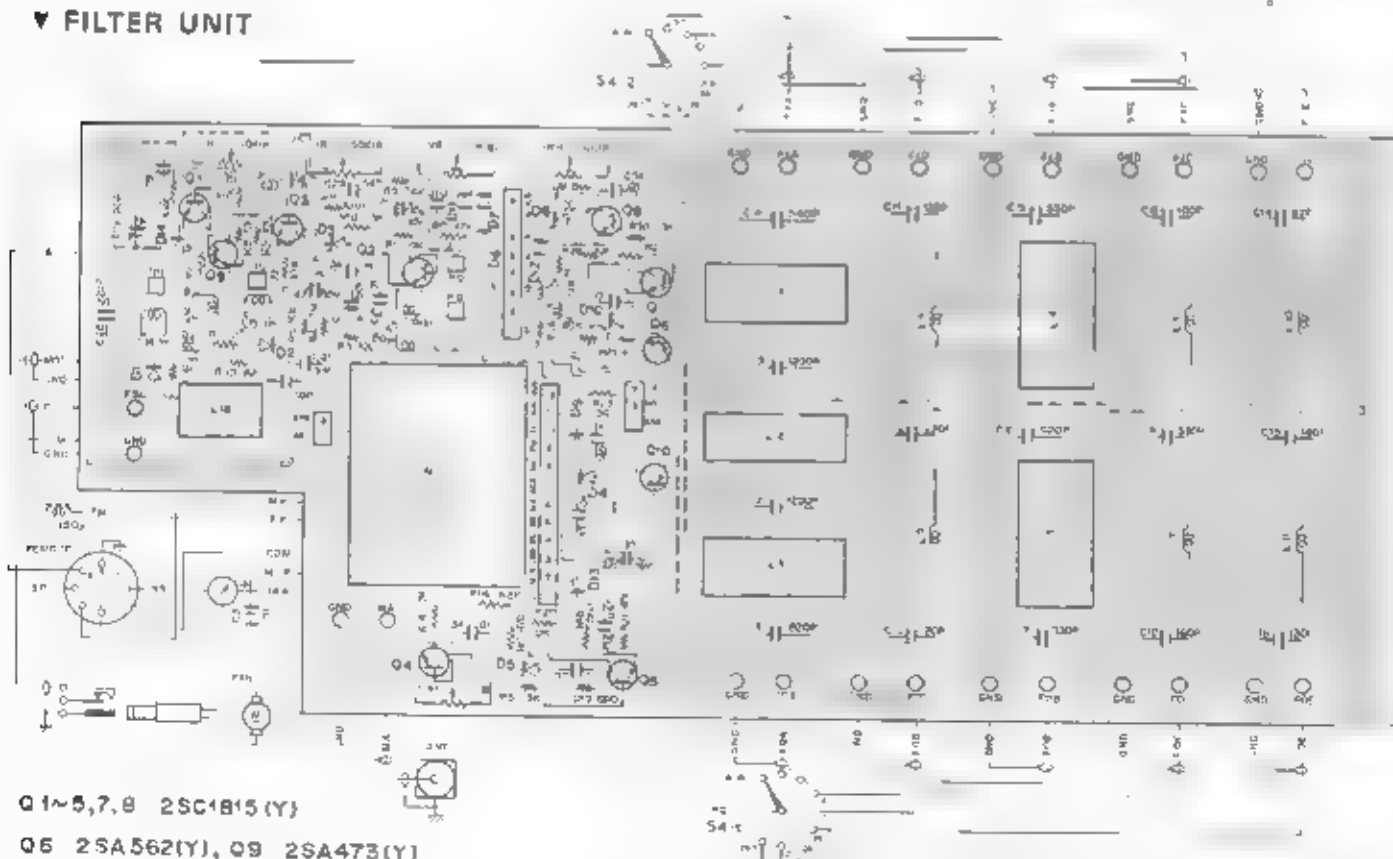
Q1, 3SK22(Y), Q2, 2SK19(Y), Q3, 2SC460(B)
Q4, 2SC1959(Y), D4, 1S2588, D5, 1SV53A

▼ CARRIER UNIT (X50-1500-00)

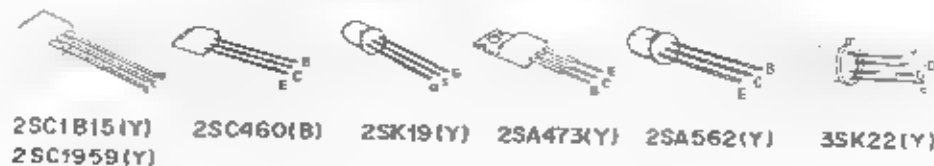
Q1,2 2SC460(B), Q3 2SC1959(Y)
D1,2,4~6 1S1555, D3 1SV53A



▼ FILTER UNIT

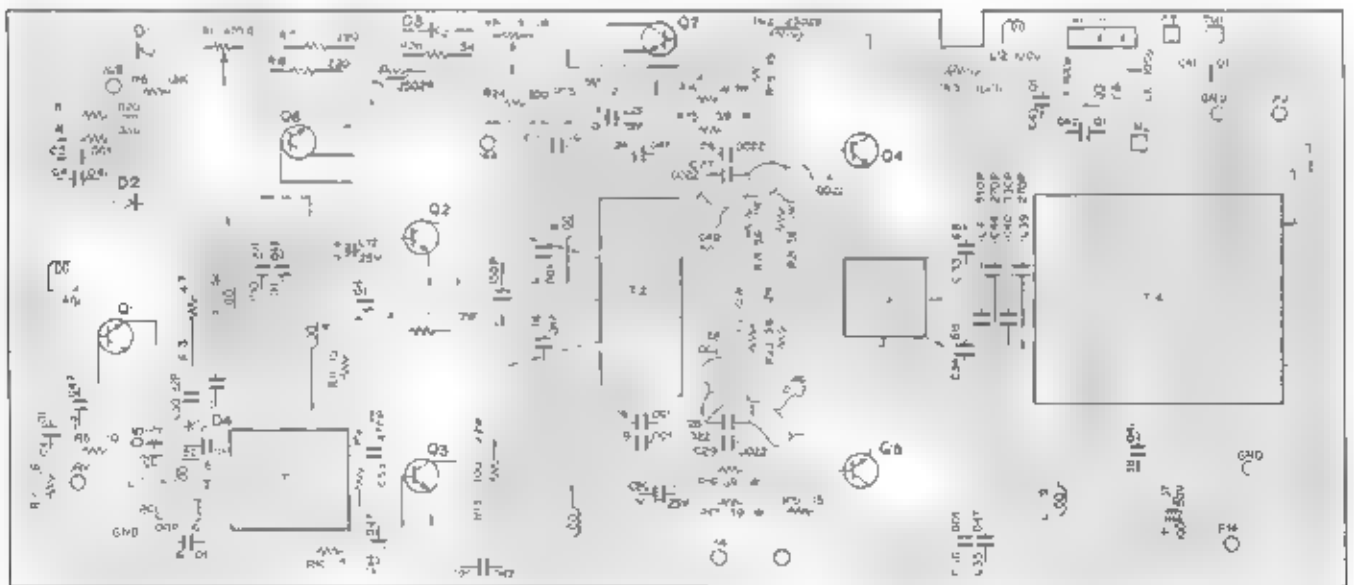
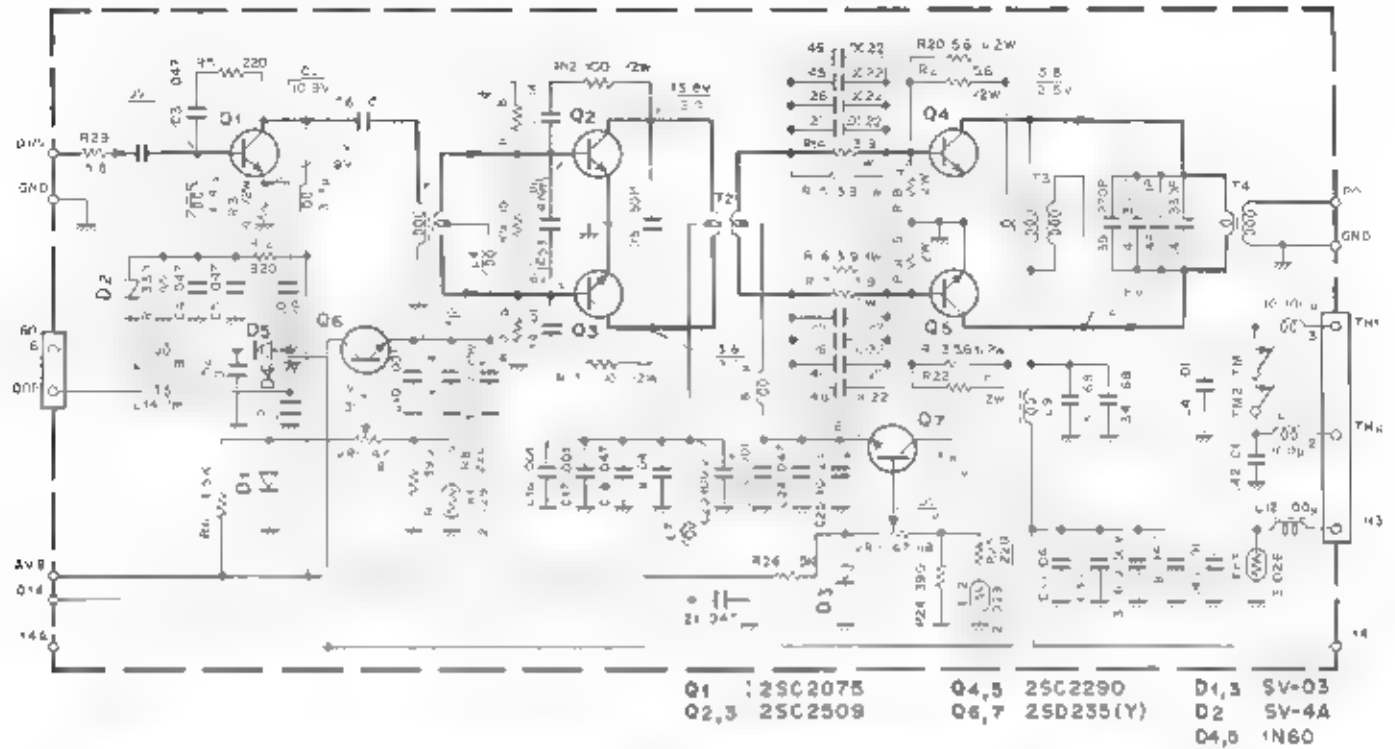


Q1~5,7,8 2SC1815(Y)
Q6 2SA562(Y), Q9 2SA473(Y)
D1,2 1N60, D3 WZ-044
D4,6,7,9,12 1S1555
D5,10 WZ-061, D8,11,13 WZ-090



PC BOARD VIEWS/CIRCUIT DIAGRAM

▼ FINAL UNIT (X56-1350 00)



2SC2075 2SD235(Y)

2SC2509

2SC2290

PARTS LIST

Note 1

Only special type of resistors (example: cement, metal film etc.) and capacitors (example: electrolytic, variable, temp. coeff.) capacitors are detailed in the PARTS LIST. For the tolerance value of all common type components refer to the schematic diagram or the PC board illustration. Resistors not otherwise detailed are carbon type (1/4 or 1/8W).

Order carbon resistors and capacitors according to the following example:

A carbon resistor's part number is RD14BY 2E222J

A ceramic capacitor's number is CK45F1H103Z CC45TH1H220L

1. Type of the carbon resistor

3. Resistance value



Significant figure

Multiplier

2. Wattage

1/4W → 2E

1/8W → 2B

Example: 221 → 220Ω, 224 → 220kΩ
222 → 2.2kΩ, 225 → 2.2MΩ
223 → 22kΩ

4. Tolerance

J = ±5% (Gold)

K = ±10% (Silver)

Note 2

K = U.S.A. W = Europe T = Britain

CAPACITORS

Type I

CK 45 F 1H 03 2
2 3 4 5 6

Type II

CC 45 1H 1H 220 J
2 3 4 5 6

1 = Type ... Ceramic, Electrolytic etc.
2 = Shape ... Round, Square etc.
3 = Temp. range
3 = Temp. coeff.
4 = Voltage rating
5 = Value
6 = Tolerance

6. Tolerance

Type	C	D	G	J	K	M	X	Z	0	No. Type
(%)	±0.25	±0.5	±2	+5	±10	±20	+40 -20	+80 -20	+100 -0	More than 10μF -10~+50 Less than 4.7μF -10~+75

Code	B	C	D	F	G
(pF)	±0.1	±0.25	±0.5	±1	±2

(Value less than 10 pF)

CK45F

Ceramic capacitor (type I) 3

Code	B	D	E	F
Operating temperature °C	-30 +85	-30 +85	-30 +85	-10 +70

CC4500...

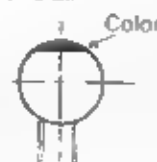
Ceramic capacitor (type I) temperature coeff. capacitor 1" 3"

Color	CH (Black)	LH (Red)	PH (Orange)	RH (Yellow)	SL (Green)	TH (Blue)	UH (Violet)
ppm/°C	0	-80	-150	220	330	470	-750

5. Capacitor value

Example: 010 → 1pF
100 → 10pF
101 → 100pF
102 → 1000pF = 0.001μF
103 → 0.01μF

CC45 ...



Type II

CK45



Type I

PARTS LIST

New parts

Ref No	Parts No.	Description	Re- marks
GENERAL			
CAPACITOR			
C	C90-0806-05	Electrolytic 2200 μ F 16V	
C3	CK45F1H-03Z	Ceramic 0.01 μ F \pm 80% -20%	
RESISTOR			
R1 ~ 3	RD-48B2E-000J	Carbon resistor 000 Ω \pm 5% 1/4W	
R5 & 6	RCDSGF2H10-J	Solid resistor 100 Ω \pm 5% 1/2W	
R7	R92-0R20-00	Cement resistor 15 m Ω	
SEMICONDUCTOR			
D1	V11-2103-05	Diode S31C	
D2	V11-7260-68	LED PR212D	
D3	V11-0240-05	Zener diode WZ-090	
POTENTIOMETER			
VR1	R06-9402-05	10k Ω (A) AF 0k Ω (B) RF	
VR2	R06-9402-05	10k Ω A-M C 10k Ω B-CAR	
VR3	R06-9403-05	5k Ω B-R T 10k Ω (F) IF SHIF	
MISCELLANEOUS			
S1	S36-2402-05	See saw switch POWER	
S2	S44-2402-05	Paddle switch STBY	
S3	S0-2417-05	Rotary switch MODE	
S4	SQ1-2417-15	Rotary switch BAND	
L2 ~ 5	L40-1511-05	Ferrinductor 150 μ H	
-	A01-0743-02	Case (A) upper	☆
-	A01-0744-02	Case (B) Lower	☆
-	A20-2349-03	Panel ass'y	☆
-	B05-0701-04	Speaker grill cloth	
-	B10-0613-04	Front glass B1	
-	B20-0611-04	Dial scale B1	
PL12	B30-0608-05	Pilot lamp \times 2	
-	B31-0618-05	Meter	
-	B39-0407-04	Spacer \times 2 for leg	
-	B42-1644-00	Indicating plate (VOX)	
-	B42-1659-14	Indicating plate ADJUSTMENT	
-	B43-0820-04	Name plate (T)	☆
-	B43-0621-04	Name plate WTRK	☆
-	B50-2643-00	Operating manual (WTRK)	☆
-	B50-2644-00	Operating manual (T)	☆
-	B5-0877-00	Service manual KHWHT	☆
-	C21-0807-05	Band shaft	
-	D22-0404-05	Universal joint	
-	D40-0603-04	Gear Ass'y	
-	E04-0152-05	M type receptacle ANT	
-	E06-0252-05	2P metal socket: I Power supply	
-	F06-0451-05	4P metal socket MIC	
-	E06-075-05	7P DiN socket REMOTE (ACSY)	
-	E06-0851-05	8P DiN socket EXT VFO SW	
-	E07-0751-05	7P DiN plug REMOTE	
-	E11-0005-15	3 pole phone jack KEY	
-	E11-0034-25	PHONES jack	
-	E1-0402-05	EXT SP jack	
-	E12-0001-05	Phone plug EXT SP (ACSY)	
-	E22-0207-05	Lug plate 1018	
-	E22-0405-05	Lug plate 3 2028	
-	E29-0407-05	Bridge connector	

Ref No	Parts No	Description	Re- marks
-	E30-1632-05	Fan Cable (with DC cord)	
-	E30-1638-05	PC Cord Ass'y ACSY1	☆
-	F05-2034-05	Fuse 20A	
-	F07-0826-05	Heat sink cover	☆
-	F09-0405-05	Fan	
-	G02-0505-05	Knob D spring \times 3	
-	H01-2619-04	Carbon (inside) 0V K	
-	H01-2620-04	Carbon (inside) T	
-	H03-1706-04	Carbon (outside) 1K	
-	H03-1707-04	Carbon (outside) 1W	☆
-	H03-1708-04	Carbon (outside) T1	☆
-	H0-2574-04	Case cover	
-	H10-2509-02	Front packing fixture	☆
-	H10-2510-02	Rear packing fixture	
-	H12-0441-04	Accessory box	
-	H20-1405-03	Protective cover	
-	H21-0701-04	Protection sheet for VOX CONTROLS	
-	J02-0323-05	Foot \times 4	
-	J02-0407-04	Tilt bracket	
-	J21-2504-04	Mounting stopper SP1	☆
-	J31-0741-04	Spacer ring for mic	
-	J42-0038-04	Hole plug	
-	J42-0407-04	Knob bush \times 2	
-	J51-0019-05	Vinyle tie \times 10	
-	J61-0210-05	Vinyle tie	
-	J61-0401-05	Nylon cable tie \times 4	
-	K21-0722-04	Main knob VFO	
-	K21-0723-04	Pointer knob large	
-	K21-0724-04	Knob (outside) \times 3	
-	K23-0710-04	Knob (side) \times 3	
-	K23-0711-04	Pointer knob (small)	
-	K23-0712-04	VOX knob \times 3	
-	K29-0709-04	Push knob (square) \times 6	
-	N14-0508-04	Spanner Nut	
-	N14-0509-05	Wing nut	
-	N19-0607-04	Nylon panel washer	
-	N99-0303-05	Hex head screw (VFO)	
-	T03-0027-15	Speaker	
-	T10-0301-05	Fan motor	☆
-	B46-0058-00	Warranty Card (K)	

SWITCH (A) UNIT (X41-1140-00)

Ref No	Parts No	Description	Re- marks
S-3	S4C-2404-05	Push switch SPJ222H	

SWITCH (B) UNIT (X41-1150-00)

Ref No	Parts No.	Description	Re- marks
R1	RD14CB2E681J	Carbon resistor 680 Ω \pm 5% 1/4W	
D1	V11-0076-05	Diode 1S-555	
S1 ~ 3	S40-2405-05	Push switch SPJ222E	
C1	CK45F1H103Z	Ceramic 0.01 μ F \pm 80% -20%	

PARTS LIST

RELAY UNIT (X41-1250-00)

Ref No	Parts No	Description	Re marks
CAPACITOR			
C	CK45F H 03Z	Ceramic 0.0 μ F 80% 20%	
C2	CE04W HR47	Electrolytic 0.47 μ F 50WV	
RESISTOR			
R12	RD14BB2E	Carbon resistor 1% 5% 1/4W	
SEMICONDUCTOR RELAY			
Q1	V03 1959-06	Transistor ZSC1959 Y	
D D2	V1 0076-05	Diode S1555	
	S5 2408-05	Relay G2V2	

DC CABLE ASS'Y (E30-1638-05)

Ref No	Parts No	Description	Re marks
-	E30-1837-05	Cable	
-	F05-2034-05	Fuse 20A	
-	V13-0404-05	Fuse holder	
-	V61-0201-05	Vinyle tie x 10	

RF UNIT (X-1260-01)

Ref No	Parts No	Description	Re marks
CAPACITOR			
C1	CC45RH1H101J	Ceramic 100pF \pm 5%	
C3	CC09S1H102J	Styrene 1000pF \pm 5%	
C5	CC45RH1H221J	Ceramic 220pF \pm 5%	
C6	CC45RH1H151J	Ceramic 150pF \pm 5%	
C7	CC45RH1H221J	Ceramic 220pF \pm 5%	
C9	CC45RH H820J	Ceramic 82pF 5%	
C11	CC45RH1H390J	Ceramic 39pF \pm 5%	
C12	CC45RH1H 01J	Ceramic 100pF \pm 5%	
C15	CC45RH1H100D	Ceramic 10pF \pm 0.5pF	
C16	CC45RH1H270J	Ceramic 27pF \pm 5%	
C17	CC45RH1H330J	Ceramic 33pF \pm 5%	
C20	CC45RH1H330J	Ceramic 33pF \pm 5%	
C21	CC45RH H100D	Ceramic 10pF \pm 0.5pF	
C22	CC45RH H050C	Ceramic 5pF \pm 0.25pF	
C25	CC45RH1H030C	Ceramic 3pF \pm 0.25pF	
C26	CC45RH H070C	Ceramic 7pF \pm 0.25pF	
C27	CC45RH1H270J	Ceramic 27pF \pm 5%	
C31 32	C90-0262-05	Ceramic 0.047 μ F 25WV	
C33	CC45SL1H070C	Ceramic 7pF \pm 0.25pF	
C35	C90-0262-05	Ceramic 0.047 μ F 25WV	
C37 ~ 39	C90-0262-05	Ceramic 0.047 μ F 25WV	
C40	CC45SL1H220J	Ceramic 22pF \pm 0.5pF	
C41	C90-0262-05	Ceramic 0.047 μ F 25WV	
C43	CC45SL1H150J	Ceramic 15pF \pm 5%	
C44	CC45SL1H220J	Ceramic 22pF \pm 5%	
C45	CC45SL1H270J	Ceramic 27pF \pm 5%	
C46 47	C91-0455-05	Ceramic 0.01 μ F	
C49 50	C90-0262-05	Ceramic 0.047 μ F 25WV	
C56	C90-0262-05	Ceramic 0.047 μ F 25WV	
C58	C90-0262-05	Ceramic 0.047 μ F 25WV	
C61	CC45SL1H221J	Ceramic 220pF \pm 5%	
C63	CE04W C100	electrolytic 10 μ F 16WV	
C64	CE04W1C100	Ceramic 10 μ F 16WV	

Ref No	Parts No	Description	Re marks
C66	C91-0455-05	Ceramic 0.047 μ F 25WV	
C69	CE04W1H4R7	Electrolytic 4.7 μ F 50WV	
C74	CC45RH1H120J	Ceramic 12pF \pm 0.25pF	
C76	CC45RH1H101J	Ceramic 100pF \pm 5%	
C78	CC45SL H050C	Ceramic 5pF \pm 0.25pF	
RESISTOR			
R1 66	RD14CB2E	Carbon Resistor 10 Ω \pm 5% 1/4W	
R22 32	NOT USED		

SEMICONDUCTOR			
Q1	V09 1002-56	FET	3SK74(L)
Q2	V03 1815-06	Transistor	2SC1815(Y)
Q3 ~ 6	V09 1002-56	FET	3SK74(L)
Q7 8	V03 1815-06	Transistor	2SC1815(Y)
Q9	V03 2086-06	Transistor	2SC2086
Q10	V01-1015-04	Transistor	2SA1015(Y)
D1	V11-0370-05	Diode	1S1587
D2	V11-0414-05	Diode	1S2588
D3	V11-0370-05	Diode	1S1587
D4	V11-0414-05	Diode	1S2588
D5	V11-0370-05	Diode	1S1587
D6	V11-0076-05	Diode	1S1555
D7	V11-0081-05	Diode	1N80
D8	V11-3172-76	Diode	1S1585

COIL INDUCTOR TRANSFORMER			
L1	L34-0559-05	Trap coil	8.83 MHz
L2	L34-0559-05	Trap coil	8.83 MHz
L3	L34-0698-05	BPF coil	3.5 MHz
L4	L34-0699-05	BPF coil	3.5 MHz
L6	L34-0698-06	BPF coil	3.6 MHz
L8	L34-0700-05	BPF coil	7 MHz
L7	L34-0701-05	BPF coil	7 MHz
L8	L34-0700-05	BPF coil	7 MHz
L9	L34-0702-05	BPF coil	14 MHz WWV
L10	L34-0703-05	BPF coil	14 MHz WWV
L11	L34-0702-05	BPF coil	14 MHz WWV
L12	L34-0704-05	BPF coil	21 MHz
L13	L34-0705-5	BPF coil	21 MHz
L14	L34-0706-05	BPF coil	21 MHz
L15	L34-0707-05	BPF coil	28 MHz
L16	L34-0717-05	BPF coil	28 MHz
L17	L34-0738-05	BPF coil	28 MHz
L18 19	L40-1021-03	Ferr inductor	1 mH
L20	L40-1011-03	Ferr inductor	100 μ H
L21	L40-1592-02	Ferr inductor	1.5 μ H
L22 23	L40-4711-03	Ferr inductor	470 μ H
L24	L40-4782-02	Ferr inductor	0.47 μ H
L25 27	L40-4711-03	Ferr inductor	470 μ H
L28 29	L40-1021-03	Ferr inductor	1 mH
L30 31	L40-1011-03	Ferr inductor	100 μ H
L32	L40-4791-02	Ferr inductor	4.7 μ H
L33	L33-0032-05	Choke coil	3 μ H
L34	L40-1011-03	Ferr inductor	100 μ H
L35	L34-0559-05	Trap coil	8.83 MHz
T1	L34-0698-35	Input coil	ANT
T2	L19-0303-05	Wide range transformer	
T3 4	L34-0697-05	Output coil	
T5	L19-0303-05	Wide band transformer	
T6	L19-0302-05	Wide band transformer P DRV	

MISCELLANEOUS			
-	S29-3404-15	Rotary wafers ass'y	

PARTS LIST

IF UNIT (X48-1210 01)

Ref. No	Parts No.	Description	Re- marks
CAPACITOR			
C	CC45SL1H050C	Ceramic 5pF $\pm 0.25\text{pF}$	
C3 4	CC45SL1H470J	Ceramic 47pF $\pm 5\%$	
C8	CE04W1C100	Electrolytic 10 μF 16WV	
C22	CC45SL1H470J	Ceramic 47pF $\pm 5\%$	
C23	CC45SL1H150J	Ceramic 15pF $\pm 5\%$	
C28	CC45SL1H070D	Ceramic 7pF $\pm 0.5\text{pF}$	
C34	CC45SH1H100D	Ceramic 10pF $\pm 0.5\text{pF}$	
C35	CC45SH1H470J	Ceramic 47pF $\pm 5\%$	
C38	CC45SL1H470J	Ceramic 47pF $\pm 5\%$	
C40	CE04W1H010	Electrolytic 1 μF 50WV	
C47	CE04W1H010	Electrolytic 1 μF 50WV	
C48	CC45SL1H030C	Ceramic 3pF $\pm 0.25\text{pF}$	
C50	CC34SL1H470K	Ceramic 470pF $\pm 10\%$	
RESISTORS			
R -61	RD4CB2E700J	Carbon resistor 0.5% 1.4W	
SEMICONDUCTOR			
Q1 -3	V08-1002-56	FET 3SK74(L)	
Q4	V08-0012-05	FET 2SK19(GR)	
Q5	V01-1015-06	Transistor 2SA1015(Y)	
Q5 7	V03-1815-06	Transistor 2SC1815(Y)	
Q8	V08-0012-05	FET 2SK19(GR)	
Q9 -11	V03-0078-05	Transistor 2SC460(B)	
Q12 13	V03-1815-06	Transistor 2SC1815(Y)	
D -4	V11-0370-05	Diode 1S1587	
D5	V11-4180-86	Diode 1S1007	
D6	V11-0370-05	Diode 1S1587	
D7	V11-4180-86	Diode 1S1007	
D8	V11-0370-05	Diode 1S1587	
D9 10	V11-0078-05	Diode 1S1555	
D11 12	V11-0051-05	Diode N60	
D13	V11-0078-05	Diode 1S1555	
D14 15	V11-0051-08	Diode N60	
D16	V21-0004-05	Varistor MV13	
D17 32	V11-0078-05	Diode 1S1555	
POTENTIOMETER			
VR1	R12-3045-05	10k Ω (B)	
VR2	R12-6401-05	470k Ω (B)	
INDUCTOR COIL			
L1 -5	L40-1511-03	Ferrite inductor 150 μH	*
T1 2	L34-0708-06	Tuning coil	
T3	L34-0537-05	Tuning coil	
T4	L34-0538-05	Tuning coil	
T5 6	L34-0536-05	Tuning coil	
T7	L34-0536-05	Tuning coil	
T8	L34-0535-05	Tuning coil	
T9	L34-0536-05	Tuning coil	
MISCELLANEOUS			
XF1	L71-0208-05	Crystal filter 4 element monolithic	*
CF 2	L72-0310-05	Ceramic filter for NB	*
	E23-0048-04	Terminal (Square)	
	S51-4401-05	Relay LZN-4	

AF-GEN UNIT (X49-1110 00)

Ref. No	Parts No.	Description	Re- marks
CAPACITOR			
C1	CC45CH1H100D	Ceramic 10pF $\pm 0.5\text{pF}$	
C3	CQ92M1H333K	Mylar 0.033 μF $\pm 10\%$	
C4	CE04W1HR47	Electrolytic 0.47 μF 50WV	
C5	CE04W1A221	Electrolytic 220 μF 10WV	
C7 8	CE04W1C100	Electrolytic 10 μF 16WV	
C8	CQ92M1H104K	Mylar 0.1 μF $\pm 10\%$	
C10 11	CE04W1C102Q	Electrolytic 1000 μF 16WV	
C12	CQ92M1H104K	Mylar 0.1 μF $\pm 10\%$	
C13	CE04W1C47Q	Electrolytic 47 μF 16WV	
C14	CQ92M1H104K	Mylar 0.1 μF $\pm 10\%$	
C16	CE04W1C47Q	Electrolytic 47 μF 16WV	
C17	CE04W1H010	Electrolytic 1 μF 50WV	
C18	CQ92M1H223K	Mylar 0.022 μF $\pm 10\%$	
C19	CE04W1C100	Electrolytic 10 μF 16WV	
C20	VACANT		
C21 22	CE04W1C47Q	Electrolytic 47 μF 16WV	
C23	CQ92M1H104K	Mylar 0.1 μF $\pm 10\%$	
C24	CE04W1C221	Electrolytic 220 μF 16WV	
C30 ~33	CC45CH1H220J	Ceramic 22pF $\pm 5\%$	
C37	CC45SL1H151J	Ceramic 150pF $\pm 5\%$	
C38	CC45CH1H100D	Ceramic 10pF $\pm 0.5\text{pF}$	
C39	CC45SL1H180J	Ceramic 18pF $\pm 5\%$	
C41 42	CC45SL1H101J	Ceramic 100pF $\pm 5\%$	
C43	CE04W1H010	Electrolytic 1 μF 50WV	
C44	CE04W1A221	Electrolytic 220 μF 10WV	
C45	CE04W1E4R7	Electrolytic 4.7 μF 25WV	
C46	CE04W1H010	Electrolytic 1 μF 50WV	
C47	CQ92M1H473K	Mylar 0.047 μF $\pm 10\%$	
C48 49	CE04W1E4R7	Electrolytic 4.7 μF 25WV	
C50	CE04W1H010	Electrolytic 1 μF 50WV	
C61	CE04W1H3R3	Electrolytic 3.3 μF 50WV	
C62	CE04W1H010	Electrolytic 1 μF 50WV	
C65	CC45UJ1H220J	Ceramic 22pF $\pm 5\%$	
C66	CC45SL1H101J	Ceramic 100pF $\pm 5\%$	
C68	CC45CH1H050C	Ceramic 5pF $\pm 0.25\text{pF}$	
C64	CC45SL1H470J	Ceramic 47pF $\pm 5\%$	
C66	CC45SL1H470J	Ceramic 47pF $\pm 5\%$	
C67	CE04W1C100	Electrolytic 10 μF 16WV	
C68	CE04W1H010	Electrolytic 1 μF 50WV	
C69 70	CQ92M1H123K	Mylar 0.012 μF $\pm 10\%$	
C7	CQ92M1H104K	Mylar 0.1 μF $\pm 10\%$	
C72 73	CQ92M1H123K	Mylar 0.012 μF $\pm 10\%$	
C74	CE04W1H010	Electrolytic 1 μF 50WV	
C75	CE04W1A221	Electrolytic 220 μF 10WV	
C76 77	CE04W1A47Q	Electrolytic 47 μF 10WV	
C78	CQ92M1H223K	Mylar 0.022 μF $\pm 10\%$	
C79	CE04W1H3R3	Electrolytic 3.3 μF 50WV	
C80	CE04W1H010	Electrolytic 1 μF 50WV	
C81	CQ92M1H473K	Mylar 0.047 μF $\pm 10\%$	
C83	CQ92M1H102K	Mylar 1000pF $\pm 10\%$	
C84	CQ92M1H473K	Mylar 0.047 μF $\pm 10\%$	
C85 86	CE04W1E4R7	Electrolytic 4.7 μF 25WV	
C88	CE04W1E3R3	Electrolytic 3.3 μF 25WV	
C89	CC45SL1H101J	Ceramic 100pF $\pm 5\%$	
C90	CE04W1C220	Electrolytic 22 μF 16WV	
RESISTOR			
R1 -113	RD14CB2E700J	Carbon 0.00 Ω $\pm 5\%$ 1.4W	
	RD14BB2E700J		
R14	RS14GB30BR2J	Metal film 0.2 Ω $\pm 5\%$ 2W	
R36 80 93 NOT USED			

PARTS LIST

Ref. No.	Parts No.	Description	Re- marks
SEMICONDUCTOR			
Q1	V03 2240-06	Transistor 2SC2240 (GR)	
Q2	v30 1029-36	IC μ PC 4305H	
Q3	V01 0473-08	Transistor 2SA473 (Y)	
Q4 ~8	V03 1815-06	Transistor 2SC1815 (Y)	
Q7	v30 1045-06	IC HA 366V	
Q8	V03 0079-06	Transistor 2SC460 (B)	
Q9	V03 1959-06	Transistor 2SC1959 (Y)	
Q10 11	V03 18 5-06	Transistor 2SC1815 (Y)	
Q 2	v09 0012 05	FET 2SK19 GR	
Q13	V03 0079-06	Transistor 2SC460 (B)	
Q14	v03 1815 06	Transistor 2SC1815 (Y)	
Q15	V01 1015-06	Transistor 2SA1015 (Y)	
Q16 7	v03 1815-06	Transistor 2SC1815 (Y)	
Q18	V03 2240-06	Transistor 2SC2240 (GR)	
Q19 20	v03 1815-06	Transistor 2SC1815 (Y)	
Q21	V01 1015-06	Transistor 2SA1015 (Y)	
Q22	v01 1815 16	Transistor 2SC1815 (GR)	
Q22.23	V03 1815-06	Transistor 2SC1815 (Y)	
Q24	V01 0032-05	Transistor 2SA562 (Y)	
Q25	V03 1815-06	Transistor 2SC1815 (Y)	
D ~4	V11 0051 05	Diode 1N60	
D5	V11 0243-05	Zener diode WZ-051	
D8 ~9	v11 0414-05	Diode 1S2588	
D10	NOT USED		
D11 ~14	V11 0051 05	Diode 1N60	
D15	V11 0370-05	Diode 1S1587	
D16	VACANT		
D17 ~22	V11 0078-05	Diode 1S1555	
D23 24	v11 0051 05	Diode 1N60	
D25	V11 0078-05	Diode 1S1555	
D26	v11 0051 05	Diode 1N60	
D27 28	v11 0078 05	Diode 1S1555	
POTENTIOMETER			
VR1	R12 3025-05	10K Ω (B) RT	
VR2	R12 4018-06	50K Ω RF	
VR3	R12 0042-06	50 Ω (B) 9V	
VR4	R12 4018-05	50K Ω S DE TONE	
VR5	R12 0401 05	100 Ω BM	
VR6	R12 0405-05	330 Ω (B) ANTI VOX	
VR7	R 2 3408 05	47k Ω VOX GAIN	
VR8	R12 6402-05	220K Ω DELAY	
TRIMMER COIL INDUCTOR			
TC1 ~8	Q05 0030-16	Ceramic trimmer 20pF	
L1	L40 1021 03	Ferrite inductor 1 mH	
L2,3	L40 1511 03	Ferrite inductor 150 μ H	
L4	L40 4771 03	Ferrite inductor 470 μ H	
L5	L40 3392-03	Ferrite inductor 3.3 μ H	
L6,7	L40 1511 03	Ferrite inductor 150 μ H	
L8	L40 1021 03	Ferrite inductor 1 mH	
T1	L15 0016-05	Filter choke	
T2	L34 0567-05	Tuning coil	
MISCELLANEOUS			
	E18 0401 05	Crystal socket 4P	
	F20 0078 05	Insulating mica	
	F29 00 4 05	Shrinkable washer	

PLL UNIT (X50-1490-00)

Ref. No.	Parts No.	Description	Re- marks
CAPACITOR			
C1	CC45TH1H220J	Ceramic 22pF +5%	
C2	CC45TH1H030C	Ceramic 3pF ± 0.25 pF	
C3	CC45TH1H220J	Ceramic 22pF $\pm 5\%$	
C4	CE04W1A47D	Electrolytic 47 μ F 10WV	
C5	CC45UJ1H560J	Ceramic 56pF $\pm 5\%$	
C6	CC45UJ1H270J	Ceramic 27pF $\pm 5\%$	
C9	CC45TH1H150J	Ceramic 15pF $\pm 5\%$	
C10	CC45TH1H030C	Ceramic 3pF ± 0.25 pF	
C11	CC45TH1H220J	Ceramic 22pF $\pm 5\%$	
C12	CE04W1A47D	Electrolytic 47 μ F 10WV	
C13	CC45TH1H330J	Ceramic 33pF $\pm 5\%$	
C14	CC45TH1H470J	Ceramic 47pF $\pm 5\%$	
C17	CC45TH1H270J	Ceramic 27pF $\pm 5\%$	
C18	CC45UJ1H220J	Ceramic 22pF $\pm 5\%$	
C19	CE04W1A47D	Electrolytic 47 μ F 10WV	
C20	CC45UJ1H101J	Ceramic 100pF $\pm 5\%$	
C21	CC45UJ1H220J	Ceramic 22pF $\pm 5\%$	
C24	CE04W1C100	Electrolytic 10 μ F 16WV	
C25	CC45TH1H270J	Ceramic 27pF $\pm 5\%$	
C26	CC45TH1H150J	Ceramic 15pF $\pm 5\%$	
C27	CC45TH1H220J	Ceramic 22pF $\pm 5\%$	
C28	CE04W1A47D	Electrolytic 47 μ F 10WV	
C29 30	CC45UJ1H560J	Ceramic 56pF $\pm 5\%$	
C33	CC45TH1H270J	Ceramic 27pF $\pm 5\%$	
C34	CC45TH1H100D	Ceramic 10pF ± 0.5 pF	
C35	CC45TH1H220J	Ceramic 22pF $\pm 5\%$	
C36	CE04W1A47D	Electrolytic 47 μ F 10WV	
C37	CC45RH1H390J	Ceramic 39pF $\pm 5\%$	
C38	CC45SH1H560J	Ceramic 56pF $\pm 5\%$	
C40	CC45CH1H100D	Ceramic 10pF ± 0.5 pF	
C41	CC45CH1H020C	Ceramic 2pF ± 0.25 pF	
C43 44	C90 0262 05	Ceramic 0.047 μ F 25WV	
C46	CC45SL1H151J	Ceramic 150pF $\pm 5\%$	
C47	CC45SL1H271J	Ceramic 270pF $\pm 5\%$	
C48	CC45SL1H121J	Ceramic 120pF $\pm 5\%$	
C50 51	CC45SL1H390J	Ceramic 39pF $\pm 5\%$	
C53	CE04W1C100	Electrolytic 10 μ F 16WV	
C54 55	C90 0262 05	Ceramic 0.047 μ F 25WV	
C57 58	CC45SL1H221J	Ceramic 220pF $\pm 5\%$	
C59	CQ92M1H122K	Mylar 1200pF $\pm 10\%$	
C60	CC45SL1H390J	Ceramic 39pF $\pm 5\%$	
C61 62	CC45SL1H020J	Ceramic 82pF $\pm 5\%$	
C63	CC45SL1H390J	Ceramic 39pF $\pm 5\%$	
C65	C90 0262 05	Ceramic 0.047 μ F 25WV	
C70	CC45SL1H120J	Ceramic 12pF $\pm 5\%$	
C71	VACANT		
C73	CC45CH1H010C	Ceramic 1pF ± 0.25 pF	
C74	CC45CH1H050C	Ceramic 5pF ± 0.25 pF	
C76	CC45SL1H271J	Ceramic 270pF $\pm 5\%$	
C77	C90 0262 05	Ceramic 0.047 μ F 25WV	
C78	CE04W1A101	Electrolytic 100 μ F 10WV	
C79	C90 0262 05	Ceramic 0.047 μ F 25WV	
C80	CQ92M1H104K	Mylar 0.1 μ F $\pm 10\%$	
C81	CQ92M1H102K	Mylar 1000pF $\pm 10\%$	
C82 83	C90 0262 05	Ceramic 0.047 μ F 25WV	
C84	CE04WQJ101	Electrolytic 100 μ F 6.3WV	
C89	CE04W1A47D	Electrolytic 47 μ F 10WV	
C90	VACANT		
C95	CC45RH1H330J	Ceramic 33pF $\pm 5\%$	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
C96	CC45RH1H500	Ceramic 15pF ±5%	
C97	CC45RH1H330J	Ceramic 33pF 5%	
C100	CC45RH1H500	Ceramic 15pF ±0.5%	
C10	CC45RH1H040C	Ceramic 4pF ±0.25pF	
C102	CC45RH1H500	Ceramic 15pF ±0.5pF	
C106	CC45CH1H00J	Ceramic 0pF ±0.5pF	
C109	CC45RH1H470J	Ceramic 47pF 5%	
C110	CC45RH1H220J	Ceramic 22pF 5%	
C112	CC45RH1H560J	Ceramic 56pF 5%	
C113	CC45SL1H070D	Film 0.1F ±0.5pF	
C114	CC45RH1H330J	Ceramic 33pF 5%	
C117	CC45RH1H470J	Ceramic 47pF 5%	
C118	CC45CH1H100J	Ceramic 0pF ±0.5pF	
C119	CC45RH1H470J	Ceramic 47pF ±5%	
C127	CC45RH1H070C	Ceramic 7pF ±0.5%	
R1	RD4R2C		
R12	RD4B82C		
R17	RD1W50C		

SEMICONDUCTOR

Q12	V030078-05	Transistor	2SC46B	8
Q13	V030168-05	Transistor	2SC784	01
Q15	V030093-05	Transistor	2SC46B	8
Q16	V030068-05	Transistor	2SC784	0
Q18	V030950-06	Transistor	2SC1959	Y
Q19	V030850-06	Transistor	2SC1959	Y
Q20	V030000-05	Transistor	2SC460	B
Q21	V301048-06	IC	5N15913P	
Q13-14	V030079-05	Transistor	2SC460	B
Q15	V301048-06	C	1074	50P
Q16	V301048-06	C	1074	50P
Q17-18	V0301778-06	Transistor	2SC1775	IEI
Q20	V300173-05	C	M40	44P
Q21	V030850-06	Transistor	2SC1959	Y
Q22	V030093-05	Transistor	2SC460	B
Q23	V090093-05	FET	3N540	C
Q24-25	V030079-05	Transistor	2SC460	B
Q20	V301048-06	C	5N15913P	
Q21	V030850-06	Transistor	2SC1959	Y
D1-4	V110075-05	Diode	1S1565	
D5	V110451-18	Diode	1SV53A	
D6	V10070-05	Diode	S587	
D7	V104636	varicap	S53A	
D8	V10370-05	Diode	1S1587	
D9	V110461-36	Varicap	1SV53A	
D10	V110414-05	Diode	1S2588	
D11	V110461-36	varicap	SV53A	
D12	V10370-05	Diode	S58	
D13	V1104636	varicap	SV53A	
D14	V10370-05	Diode	S58	
D15	V10370-05	Diode	S587	
D16	NOT USED			
D17-2	V10370-05	Diode	S587	
D22-23	V1078-05	Diode	1S555	
D24-27	V103005	Diode	S587	

POTENTIOMETER

P1	P240405	GOK	Spurious
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INDUCTOR COIL

L8	L40503	Ferr. inductor	150μH
L9	L40470-03	Ferr. inductor	47μH
L10	L40592-02	Ferr. inductor	59μH
L11-2	L401092-02	Ferr. inductor	μH

Ref. No.	Parts No.	Description	Remarks
L12	L401294-02	Ferr. inductor	12μH
L14	L40270-03	Ferr. inductor	2μH
L16	L40470-03	Ferr. inductor	470μH
L17	L40151-03	Ferr. inductor	50μH
L18	L40101-03	Ferr. inductor	100μH
L19-21	L40170-03	Ferr. inductor	27μH
L22-24	L4051-03	Ferr. inductor	150μH
L25	L40100-03	Ferr. inductor	10μH
L26	L4047-03	Ferr. inductor	470μH
L27	L4015-03	Ferr. inductor	150μH
L28	L40100-03	Ferr. inductor	10μH
L29-31	L4015-03	Ferr. inductor	50μH
L31	L119R05	Sec. coil	14.4MHz
L32	L3209-05	OSC. coil	21MHz
L33	L32098-05	Sec. coil	28MHz
L34	L32095-05	OSC. coil	7MHz
L35	L32093-05	OSC. coil	35MHz
L36	L4015-05	Sec. coil	883MHz
L37	L34005-05	Tuning coil	
L38	L34075-05	Tuning coil	
L39	L3416-05	Tuning coil	
L40	L34171-05	Tuning coil	
L41	L34018-05	Tuning coil	
L42	L34075-05	Tuning coil	
L43	L3407-05	Tuning coil	
L44	L34009-05	Tuning coil	4MHz
T15	L340710-05	Tuning coil	30MHz
L45	L34002-05	Tuning coil	
L46	L340713-05	Tuning coil	
MISCELLANEOUS			
F1	F1204604	capacitor	

CAR UNIT (X50-1500 00)

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C12	CC45RH1H220J	Ceramic	22pF ±5%
C13	CC45RH1H270J	Ceramic	27pF ±5%
C14	CC45RH1H220J	Ceramic	22pF ±5%
C17-8	VACANT		
C19	CS15E1VP72M	Aluminum	0.22μF 15WV
C23	CC45SL1H020C	Ceramic	0.02pF ±5%
C14	CC45CH1H020C	Ceramic	2pF ±0.25pF
C15	CC45CH1H330J	Ceramic	33pF 5%
C16	L300262-05	Ceramic	0.047μF 25WV
RESISTOR			
R1-1	RD4CB2C	Carbon resistor	5% 1/4W
SEMICONDUCTOR			
Q12	V030079-05	Transistor	2SC460 B
Q13	V031959-06	Transistor	2SC1959 Y
C12	V1078-05	Diode	S555
Q3	41636	varicap	SV53A
Q4-5	DC605	Diode	1S1565
POTENTIOMETER			
P1-2	P2012-05	CTB	

PARTS LIST

Ref. No	Parts No	Description	Re- marks
MISCELLANEOUS			
T1 2	CD5-0056-05	Ceramic trimmer 30pF	
X	L77-0485-05	Quartz crystal 883 5 kHz	
X2	L77-0486-05	Quartz crystal 8828 5 kHz	
L1~3	L40-1511-03	Ferr-inductor 150μH	
L4	L33-0266-05	Choke coil 28μH	
L5~7	L40-1511-03	Ferr-inductor 150μH	
T1	L32-0201-05	OSC coil	

FILTER UNIT (X51-1200-00)

Ref. No	Parts No	Description	Re- marks
C1	CM93D2H821J	Mica 820pF ±5%	
C2 3	CM93D2H122J	Mica 1200pF ±5%	
C4	CM93D2H561J	Mica 560pF ±5%	
C5	CM93D2H331J	Mica 330pF ±5%	
C6	CM93D2H821J	Mica 820pF ±5%	
C7	CM93D2H331J	Mica 330pF ±5%	
C8	CM93D2H271J	Mica 180pF ±5%	
C9	CM93D2H331J	Mica 330pF ±5%	
C10	CM93D2H181J	Mica 180pF ±5%	
C11	CM93D2H121J	Mica 120pF ±5%	
C12	CM93D2H221J	Mica 220pF ±5%	
C13	CM93D2H121J	Mica 120pF ±5%	
C14	CM93D2H820J	Mica 820pF ±5%	
C15	CM93D2H181J	Mica 180pF ±5%	
C16	CM93D2H131J	Mica 130pF ±5%	
C17 18	NOT USED		
C20	CC45SL2H221J	Ceramic 220pF ±5%	
C21	CC45CH2H030J	Ceramic 3pF ±0.25 pF	
C22	CC45CH1H850J	Ceramic 56pF 5%	
C24	C91-0456-05	Ceramic 0.047μF 25WV	
C25	CE04W1H847	Electrolytic 0.47μF 50WV	
C27	CE04W1H010	Electrolytic 1μF 50WV	
C28	CE04W1C100	Electrolytic 10μF 16WV	
C29	C91-0456-05	Ceramic 0.047μF 25WV	
C3 37	NOT USED		
C36	CE04W1C221	Electrolytic 220μF 16WV	
C38	C91-0456-05	Ceramic 0.047μF 25WV	
C38	NOT USED		
C41	C91-0456-05	Ceramic 0.047μF 25WV	
C42	CM93D2H101J	Mica 100pF ±5%	
R~33	RD14CB2E000J	Carbon resistor 0000 ±5% 1/4W	
R8 7	NOT USED		
R23	RC05GF2H151J	Solid resistor 150Ω ±5% 1/2W	
R33	RD14BB2E820J	Carbon resistor 82Ω ±5% 1/4W	
Q1~5	V03-1815-06	Transistor 2SC1815 (Y)	
Q8	V01-0032-05	Transistor 2SA562 (Y)	
Q7 8,9	V03-1815-06	Transistor 2SC1815 (Y)	
Q10	V01-0473-06	Transistor 2SA473 (Y)	
D1 2	V11-0005-05	Diode 1N60	
D3	V11-4181-06	Zener diode WZ-044	
D4	V11-0076-05	Diode 1S1555	
D5	V11-0243-05	Zener diode WZ-061	
D6 7	V11-0076-05	Diode 1S1555	
D8	V11-0240-05	Zener diode WZ-090	
D9	V11-0076-05	Diode 1S1555	
D10	V11-0243-05	Zener diode WZ-061	

Ref. No	Parts No	Description	Re- marks
D11	V11-0240-05	Zener diode WZ-090	
D12	V11-0076-05	Diode 1S1555	
D13	V11-0240-05	Zener Diode WZ-090	
D14	V11-0076-05	Diode 1S1555	
VR1	R12-4016-06	Potentiometer 50kΩ (B)	
VR2	R12-3025-05	Potentiometer 10kΩ (B)	
VR3	R12-4016-05	Potentiometer 50kΩ (B)	
VR4	R12-0042-05	Potentiometer 500Ω B	
VR5	R12-1020-05	Potentiometer 1kΩ B	
TC1	CO5-0043-05	Ceramic trimmer 20pF	
RL1	SS1-4402-05	Relay	
L1 3	L34-0826-05	Filter coil (A)	☆
L4,5	L34-0827-05	Filter Coil (B)	☆
L6,7	L34-0828-05	Filter coil (C)	☆
L8,9	L34-0829-05	Filter coil (D)	☆
L10,11	L34-0830-05	Filter coil (E)	☆
L12	L40-1021-03	Ferr-inductor 1mH	
L13			
L14,15	L40-1021-03	Ferr-inductor 1mH	
L16,17	L40-1511-03	Ferr-inductor 150μH	
L18	L38-0406-05	Detector coil	☆
L18	L40-1511-03	Ferr-inductor 150μH	
-	E23-0046-04	Terminal (square) x 4	
-	E23-0401-05	Terminal (circle) x 24	
-	F20-0078-05	Insulating mica	
-	F29-0014-05	Shoulder washer	
-	J31-0502-04	Board stand (color) x 8	
-	J42-0404-05	Board stand (brush) x 8	

COUNTER UNIT (X54-1360-00)

Ref. No	Parts No	Description	Re- marks
CAPACITOR			
C	CC45SL1H330J	Ceramic 33pF ±5%	
C2	CC45SL1H391J	Ceramic 390pF ±5%	
C3	CC45CH1H470J	Ceramic 47pF 5%	
C4	C90-0262-05	Ceramic 0.047μF 25WV	
C5	CC45SL1H150J	Ceramic 15pF ±5%	
C6	CC45SL1H020C	Ceramic 2pF ±0.25pF	
C7	CC45SL1H100D	Ceramic 10pF ±0.5pF	
C10	C90-0262-05	Ceramic 0.047μF 25WV	
C11	CE04W0J101Q	Electrolytic 100μF 6.3WV	
C12	CC45SL1H101J	Ceramic 100pF ±5%	
C13	C90-0262-05	Ceramic 0.047μF 25WV	
C14	CC45SL1H390J	Ceramic 39pF ±5%	
C15	CC45SL1H330J	Ceramic 33pF ±5%	
C16	CC45SL1H101J	Ceramic 100pF ±5%	
C17	CC45SL1H221J	Ceramic 220pF ±5%	
C18	CC45SL1H220J	Ceramic 22pF ±5%	
C19	CC45SL1H050C	Ceramic 5pF ±0.25pF	
C20	C90-0262-05	Ceramic 0.047μF 25WV	
C21	CC45SL1H101J	Ceramic 100pF ±5%	
C22	CC45SL1H270J	Ceramic 27pF ±5%	
C23	CC45SL1H560J	Ceramic 56pF ±5%	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
C24	CC45SL1H270J	Ceramic 27pF ±5%	
C25	CC45SL1H470J	Ceramic 47pF ±5%	
C26	NOT USED		
C27-28	CC45SL1H470J	Ceramic 47pF ±5%	
C29	C90-0262-05	Ceramic 0.047μF 25WV	
C31	C90-0262-05	Ceramic 0.047μF 25WV	
C32	CC45SL1H 21J	Ceramic 120pF ±5%	
C33	CC45SL1H271J	Ceramic 270pF ±5%	
C34	CC45SL1H121J	Ceramic 120pF ±5%	
C36	C90-0262-05	Ceramic 0.047μF 25WV	
C38	C90-0262-05	Ceramic 0.047μF 25WV	
C41	CE04W0.010	Electrolytic 100μF 6.3WV	
C44	CE04W1H 57K	Mylar 1500pF 10%	
C45-56	C90-0262-05	Ceramic 0.047μF 25WV	
C47-48	CE04W0.221Q	Electrolytic 22μF 6.3WV	
C49	CE04W1V100Q	Electrolytic 10μF 35WV	
C51-53	CE04W1V 00Q	Electrolytic 10μF 35WV	
C55-58	C90-0262-05	Ceramic 0.047μF 25WV	

RESISTOR

R1-57	RD14C82E000J	Carbon resistor 000Ω ±5% 1/4W	
R13	NOT USED		
R8	R90-0506-05	47kΩ ± 47kΩ × 6	
R82-3	R90-0521-05	47kΩ × 7	
R84-5	R90-0522-05	47kΩ × 6	

SEMICONDUCTOR

Q1~5	V03-18 5-06	Transistor 2SC1815 (V)	
Q6	V03-0473-05	Transistor 2SC785 (Q)	
Q7	V09-002 48	FET 3SK73 (H)	
Q8~10	V03-1815-08	Transistor 2SC1815 (V)	
Q 2	V03-859 06	Transistor 2SC 959 (V)	
Q12	V03-1815-08	Transistor 2SC1815 (V)	
C1	V30-005 26	C TC5026BP	
C2	V30-040 06	C TC5026BP	
C3-4	V30-1039-06	C TC5018BP	
C5	V30-050 06	C TC5027BP	
C6-7	V30-1030-08	IC TC4011BP	
C8	V30-056 08	C TC5051BP	
C9	V30-05 06	C TC4029BP	
C10	V30-052 06	C TC4042BP	
C11-3	V30-049 06	C TC40 9BP	
C14	V30-109 26	C TC4049BP	
C15	V30-054 06	C TC5027BP	
C16	V30-057 06	C TC5060BP	
C18	V30-051 06	C TC5012BP	
C19	V30-056 06	C TC5064BP	
D1	V11-0240-06	Zener diode WZ 080	
D2	VACANT		
D3-8	V 0076 05	Diode S 555	
D19	V11-4180-86	Zener diode WZ-071	
D20	V11-4162-86	Zener diode XZ 060	
D21~24	V11-0076-05	Diode 1S1555	
D25	V21-0004-05	Varistor MV 13	

MISCELLANEOUS

TC	V40-7760-05	Indicating tube 9-BT 12	☆
L1-2	L40-4711-03	Ferrite inductor 470μH	
L3-4	L40-4701-03	Ferrite inductor 47μH	
L5	L40-4711-03	Ferrite inductor 470μH	
L6-7	L40-2711-03	Ferrite inductor 270μH	
L8	L40-4711-03	Ferrite inductor 470μH	
L9	L33-0676-05	Choke coil 43μH	☆

ET10-11	L40-4711-03	Ferrite inductor 470μH	
L12-13	L40-1511-03	Ferrite inductor 150μH	
T1	L19-0305-05	Oscillator transformer	☆
X2	L77-0482-05	Quartz crystal 10 MHz	
-	E31-0430-15	Ribbon conductor	

FINAL UNIT (X56-1350 00)

Ref. No.	Parts No.	Description	Remarks
C1	C91-0455-05	Ceramic 0.047μF 25WV	
C3	C91-0456-05	Ceramic 0.047μF 25WV	
C4	C91-0458-05	Ceramic 0.047μF 25WV	
C5	CK45B1H102K	Ceramic 0.001μF ±10%	
C6	C91-0455-05	Ceramic 0.047μF 25WV	
C7	NOT USED		
C10	CK45B1H102K	Ceramic 0.001μF ±10%	
C	C91-0456-05	Ceramic 0.047μF 25WV	
C12	CE04W1E100	Electrolytic 100μF 25WV	
C13-14	C91-0456-05	Ceramic 0.047μF 25WV	
C15	CM93AD2H151J	Mica 150pF ±5%	
C16-17	CK45B1H102K	Ceramic 0.001μF ±10%	
C18-19	C91-0456-05	Ceramic 0.047μF 25WV	
C20	CE04W1E101	Electrolytic 100μF 25WV	
C21	C91-0456-05	Ceramic 0.047μF 25WV	
C22	NOT USED		
C23	CK45B1H102K	Ceramic 0.001μF ±10%	
C24	C91-0458-05	Ceramic 0.047μF 25WV	
C25	CE04W1E100	Electrolytic 100μF 25WV	
C26-29	CK45B1H222KM	Ceramic 0.0022μF 10%	
C30~32	NOT USED		
C33-34	C91-0458-05	Ceramic 0.047μF 25WV	
C35	C91-0456-05	Ceramic 0.047μF 25WV	
C36	CK45B1H102K	Ceramic 0.001μF ±10%	
C37	CE04W1H101Q	Electrolytic 100μF 50WV	
C38	C91-0456-05	Ceramic 0.047μF 25WV	
C39	CM93AD2H271J	Mica 270pF ±5%	
C40	CM93AD2H331J	Mica 330pF ±5%	
C41-43	C91-0455-05	Ceramic 0.047μF 25WV	
C44	CM93AD2H271J	Mica 270pF ±5%	
C45-46	CK45B1H222KM	Ceramic 0.0022μF ±10%	
C47	CM93AD2H331J	Mica 330pF ±5%	
C48-49	CK45B1H222KM	Ceramic 0.0022μF ±10%	
C50	C91-0456-05	Ceramic 0.047μF 25WV	
C51-52	C90-0455-05	Ceramic 0.047μF 25WV	
C53	CM93AD2H471T	Mica 470pF ±5%	
R1-27	RD14C82E000J	Carbon resistor 000Ω ±5% 1/4W	
	RD14C82E000J		
R3	RC05GF2H4R7J	Solid resistor 4.7Ω ±5% 1/2W	
R12-13	RC05GF2H101J	Solid resistor 100Ω ±5% 1/2W	
R14~17	RS14AB3A3R9J	Meta-film 3.9Ω ±5% 1W	
R18~23	RC05CF2H5R6J	Solid resistor 5.6Ω ±5% 1/2W	
Q1	V03-2075-06	Transistor 2SC2075	
Q2-3	V03-2509-06	Transistor 2SC2509	
Q4-5	V03-2290-16	Transistor 2SC2290	☆
Q6-7	V04-0048-05	Transistor 2SD235 (V)	
D1	V22-0031-05	Varistor SV-03	
D2	V11-4363-36	Varistor SV-4A	
D3	V22-0031-05	Varistor SV-03	
D4-5	V11-0051-05	Diode 1N60	

PARTS LIST

Ref No	Parts No	Description	Re- marks
Th 2	3360-6	Thermistor 25029	
Th3	V11 7782-18	Thermistor 31026	
VR12	R12 0058-05	Potentiometer 47K (B)	
M1	S59-1404-05		☆
TM2	S59-1403-05		☆
L1	L40-470-03	Ferr. inductor 47μH	
L2	L33-0025-05	RFC	
L3,4	L33-0032-05	RFC	
L5,6	NOT USED		
L7	L33-0612-05	RFC	
L8	L33-0025-05	RFC	
L9	L33-0625-05	RFC	
L10 ~ 12	L40-1011-04	Ferr. inductor 100μH	
L13,14	L40-1021-04	Ferr. inductor 1mH	
T1	L19-0317-05	Wide band transformer	☆
T2	L19-0311-05	Input transformer	☆
T3	L19-0313-05	RF Transformer	☆
T4	L19-0312-05	Output transformer	☆
-	F04-0-52-05	Mounting bracket	
-	E08-0271-05	DC socket	
-	E23-0043-04		
-	E23-0046-04	Trimming square x 4	
-	E23-0401-05	Trimming screw x 8	
-	F01-0735-05		
-	F20-0078-05	Insulating mica x 3	
-	F29-0014-05	Shoulder washer x 3	
-	J31-0503-05	Beads x 4	
-	J32-0730-04	Hex. boss	☆
-	N14-0509-05	Wing nut	

VFO ASS'Y UNIT (X60-1070-00)

Ref No	Parts No	Description	Re- marks
GENERAL			
-	B0-0515-05	Dial scale/canon	
-	B10-0612-04	Front plate A	
-	B20-0810-04	Dial scale A	
-	G01-0804-04	Coupling spring	
-	K21-0722-04	Main knob	
-	N18-0808-04	Washer x 2	
-	X40-1130-00	VFO unit	

VFO UNIT (X40-1130-00)

Ref No	Parts No	Description	Re- marks
CAPACITOR			
C2	CC45S1H390J	Ceramic 39pF ±5%	
C3	CC45CH1H000	Ceramic 10pF ±0.5pF	
C4	CC45S1H390J	Ceramic 39pF ±5%	
C7	C90-0262-05	Ceramic 0.047μF 25WV	

Ref No	Parts No	Description	Re- marks
C8	CC45CH1H020C	Ceramic 2pF ±25pF	
C10,11	C90-0262-05	Ceramic 0.047μF 25WV	
C12	CC45SG1H050C	Ceramic 5pF ±0.25pF	
C13	CC45LG1H470J	Ceramic 47pF ±5%	
C14	CC45LG1H220J	Ceramic 22pF ±5%	
C15,16	CC45LG1H151J	Ceramic 150pF ±5%	
C17	CC45SG1H150J	Ceramic 15pF ±5%	
C18	CC45RG1H 20J	Ceramic 12pF ±5%	
C19	CC45LG1H151J	Ceramic 150pF ±5%	
C20	CC45CG1H121J	Ceramic 120pF ±5%	
RESISTOR			
R ~ 14	RD14C82E300J	Carbon resistor (COX) ±5% 1/4W	
SEMICONDUCTOR			
Q1	V09-0020-05	FET 3SK22 (Y)	
Q2	V09-0011-05	FET 2SK19 (Y)	
Q3	V03-0079-05	Transistor 2SC460 (B)	
Q4	V03-1959-05	Transistor 2SC1959 (Y)	
D4	V11-0414-05	Diode 1S2588	
D5	V1104161-35	Diode 1SV53A	
TRIMMER/VC			
TC2	C05-0305-05	Ceramic trimmer 2p	
-	C05-0013-15	Ceramic trimmer 20pF	
-	C02-0010-05	Variable capacitor	
INDUCTOR COIL			
L1,2	L40-4711-03	Ferr. inductor 470μH	
L3	L40-1501-03	Ferr. inductor 15μH	
L5 ~ 7	L40-4711-03	Ferr. inductor 470μH	
L8	L33-0025-05	Choke coil 1μH	
L9	L32-0609-05	Oscillator coil B	
L10	L32-0608-05	Oscillator coil A	
MISCELLANEOUS			
-	B42-1646-04	Indication tube	
-	D22-0405-04	Coupling	
-	D40-0604-05	Dial mechanism	
-	F30-63-05	P.P. pin x 4	
-	E23-0046-04	Terminal square x 4	

EXPLODED VIEW/DISASSEMBLY

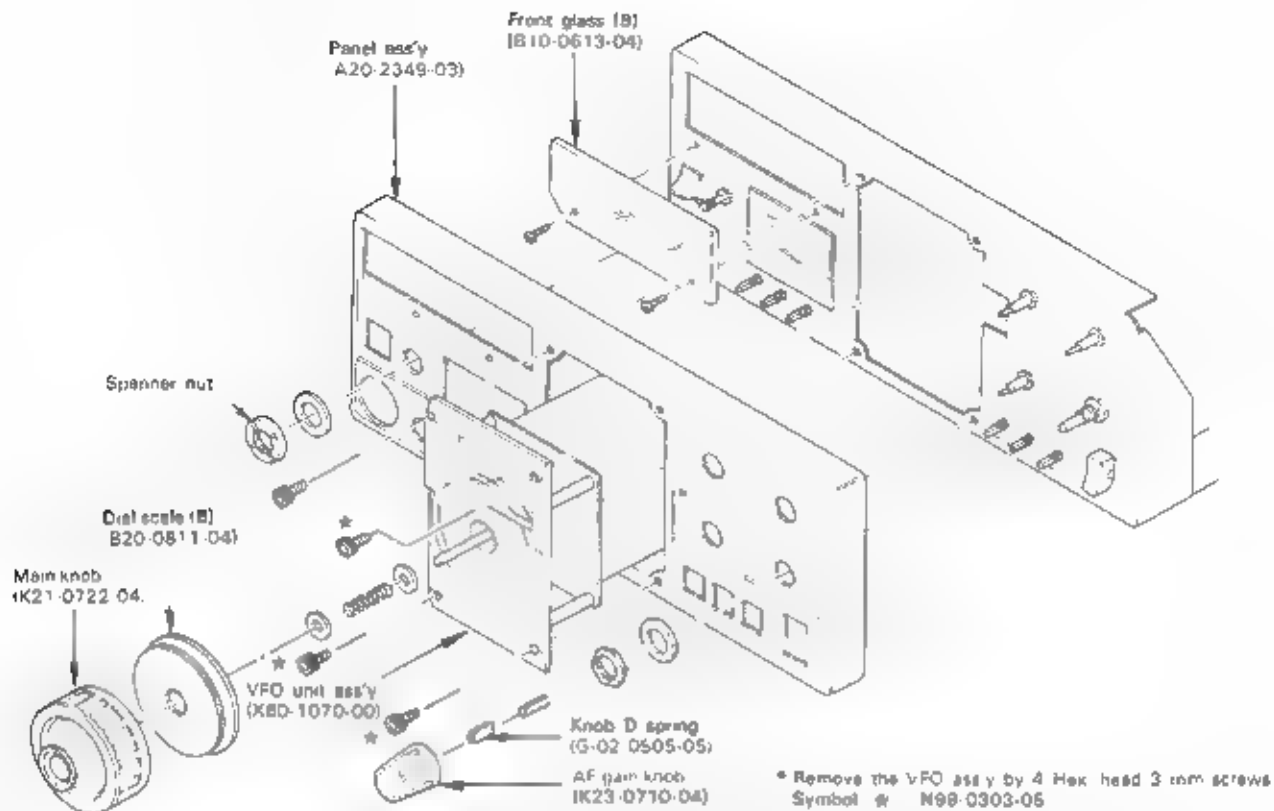


Fig. 7 Front panel exploded view/removing the VFO ass'y

No.	Description	Parts No.	Remarks
1	Subpanel	A22-0 4 3)	
2	ON/OFF switch	N09-0268-05)	
3	Toggle switch	3D1 410-05	MODE
4	Phone jack	E 0034-05	PHONE
5	4P Mic socket	808 045 08	MIC
6	Push/Pull switch	344 2402-05	AF AF
7	Switch unit B	X41 1450-00	RIT IF SHIFT
8	Master	03 05 0 05	
9	Master housing	529-0404-05	
10	Potentiometer	406-9407-05	MIC GAIN
11	Potentiometer	406 9402-05	AF AF
12	Potentiometer	1105 9403-05	RIT IF SHIFT
13	Over AMP	040 0803-05	
14	Seesaw switch	536 2402-05	POWER
15	Switch unit (A)	X41 140 00	
16	Screw	N30-2604-48	
17	Screw	N34 3004-48	

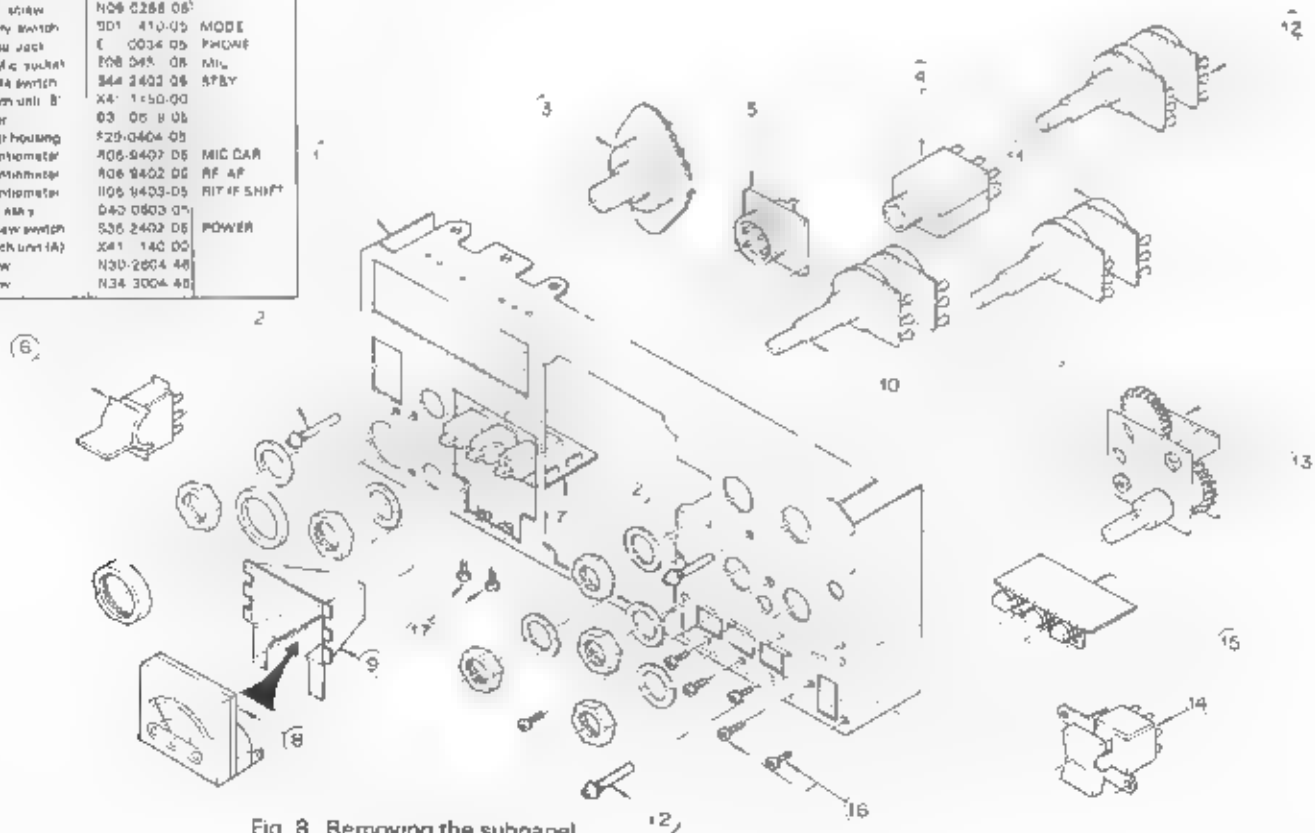


Fig. 8 Removing the subpanel

PACKING/DISASSEMBLY

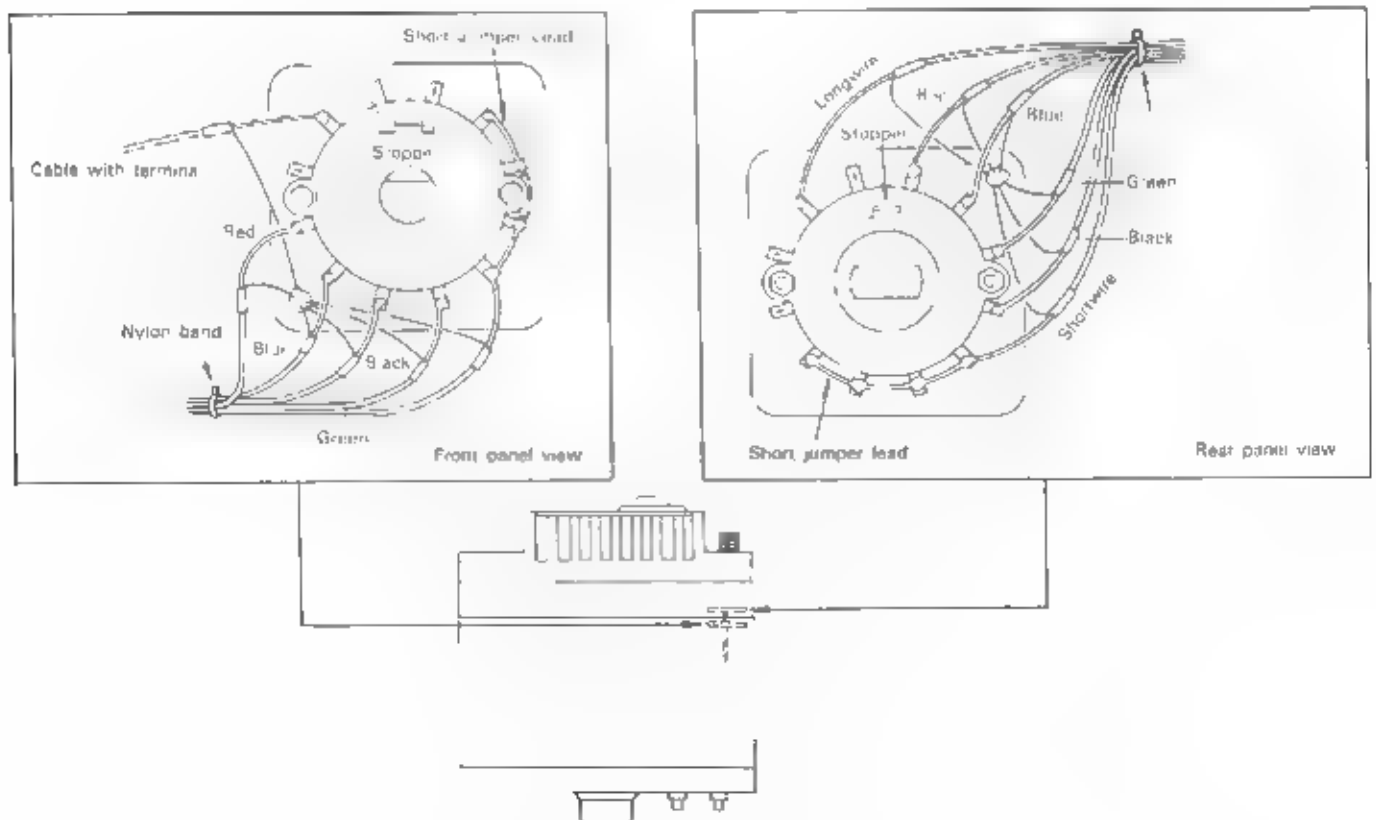
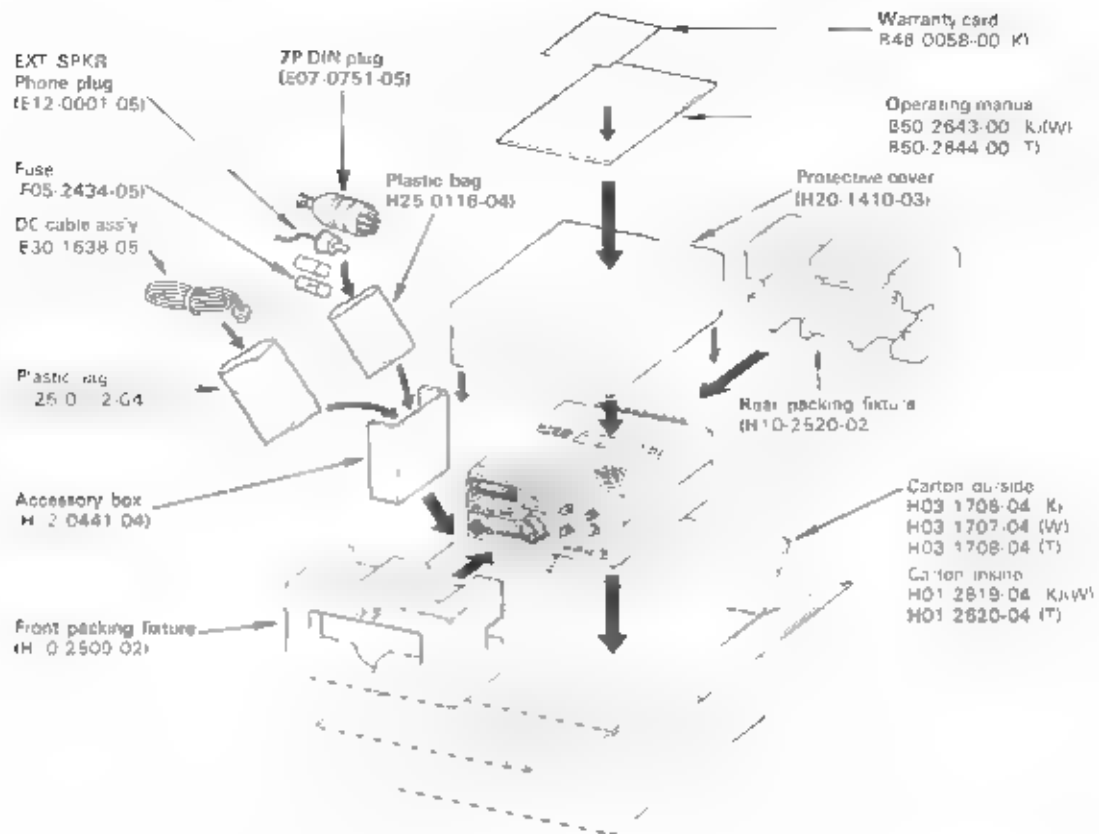


Fig. 6 BAND rotary switch (S01-2417-05) wiring.

DISASSEMBLY

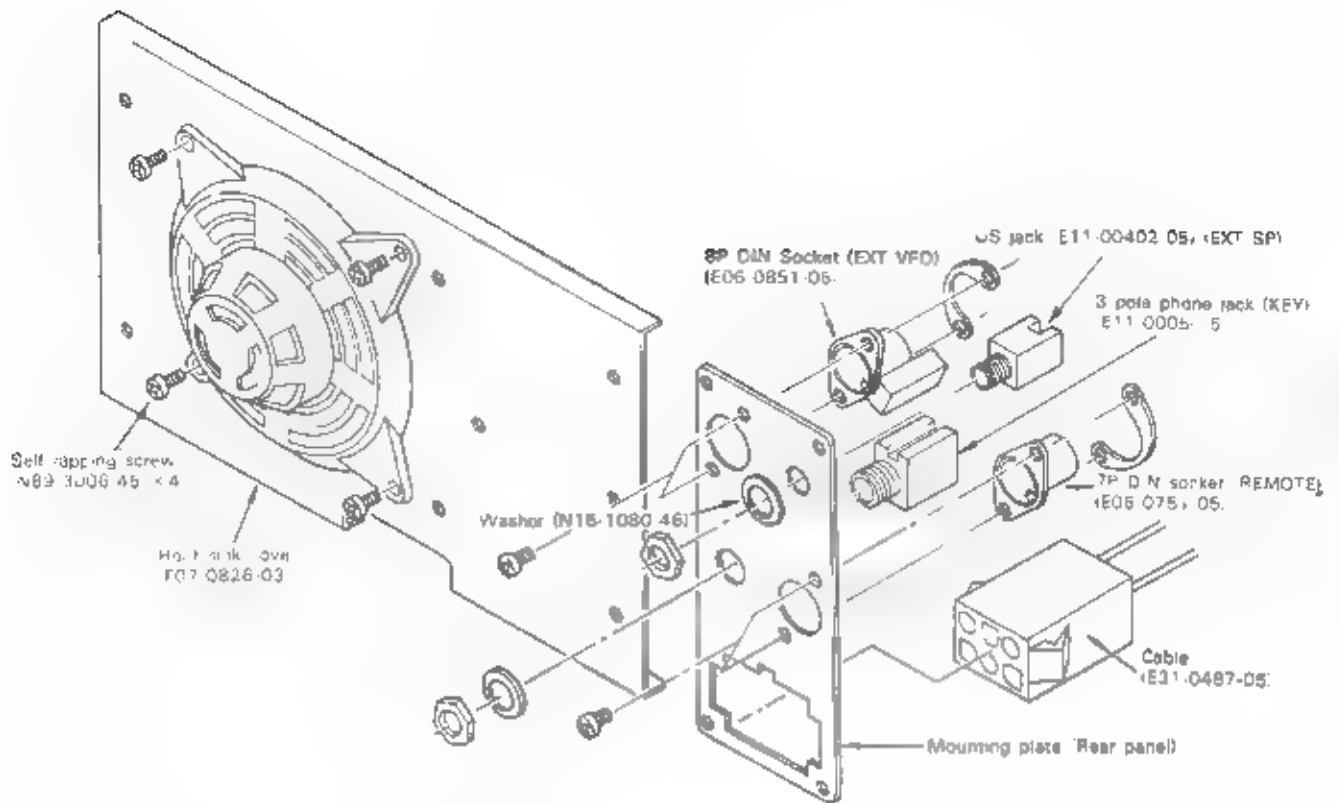


Fig. 9 Heat sink cover and Rear panel disassembly

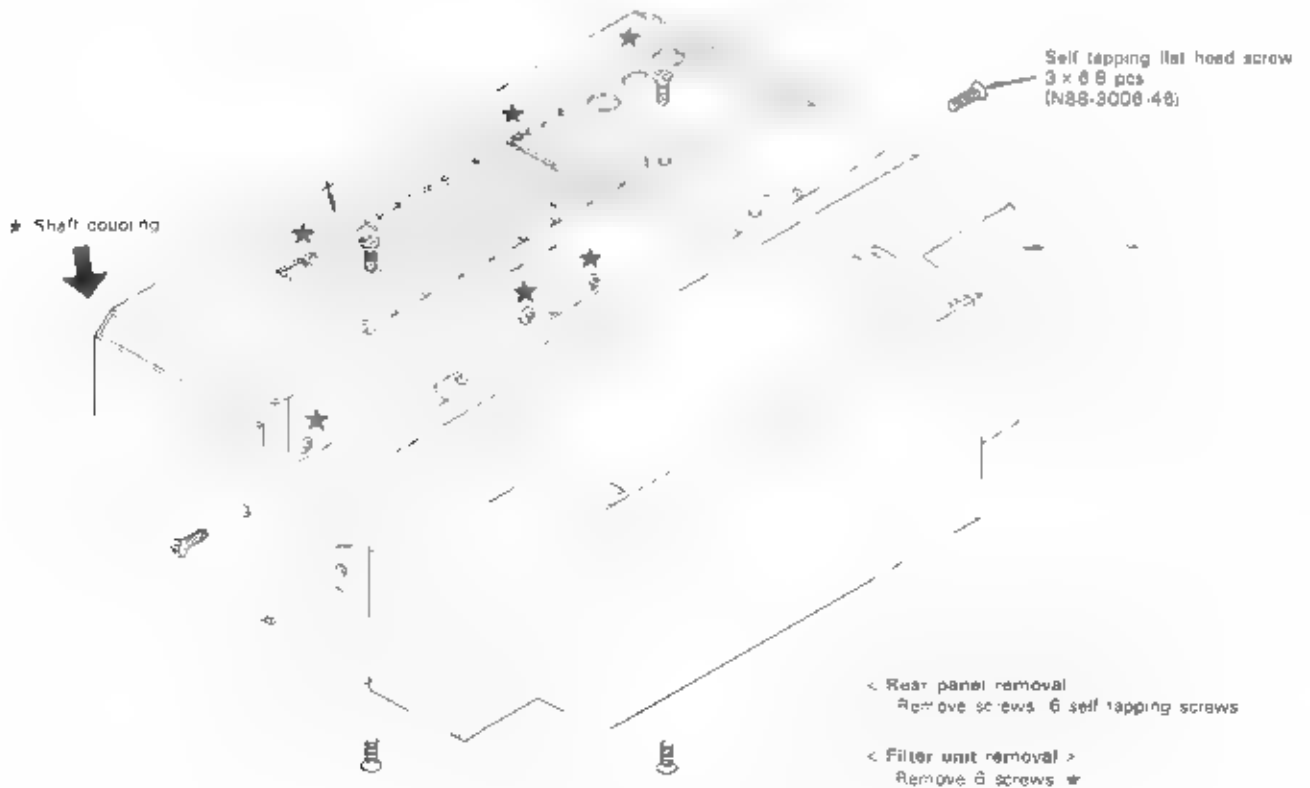


Fig. 10 Rear panel/filter unit removal

DISASSEMBLY

• To gain access to the RF unit >

- 1 Remove the six screws from the IF unit (as shown at right).
- 2 Remove the four shield screws.
- 3 Remove the shield.

★ Self tapping screw
(N89 3005-46)

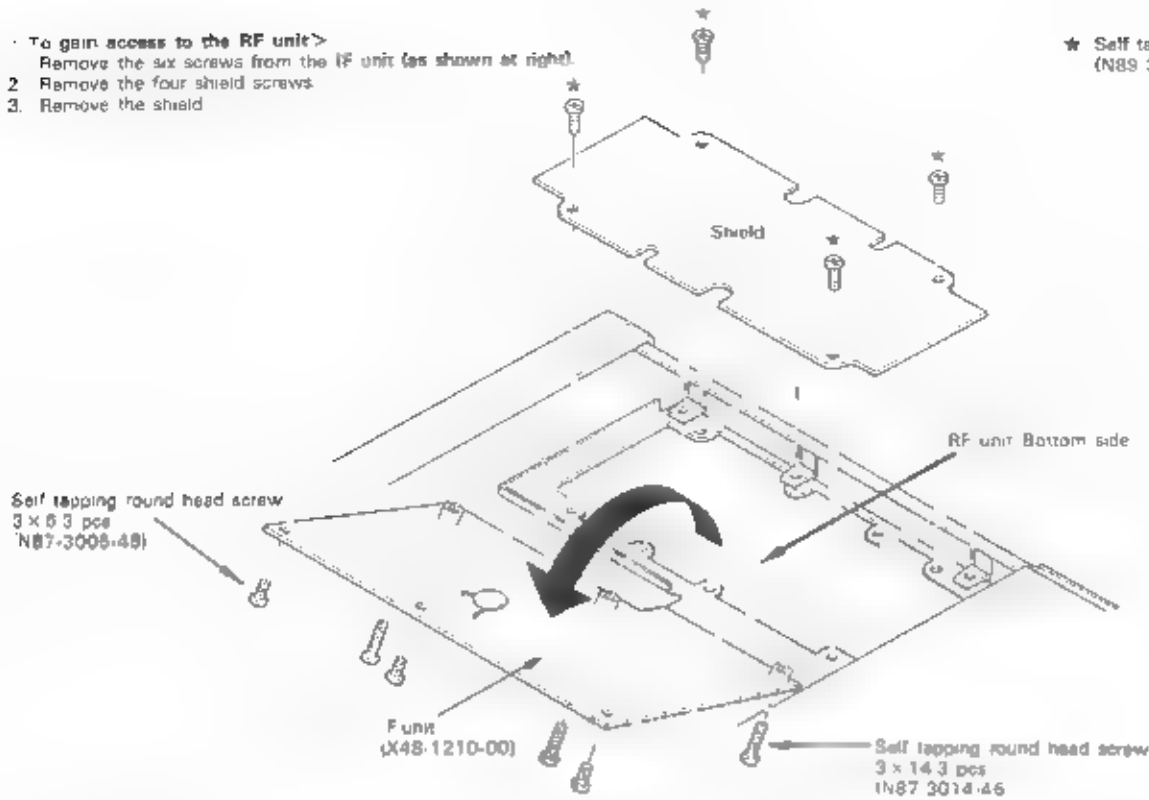


Fig. 11 Repairing the RF unit

• Removing the counter unit >

- 1 Remove the six screws from the AF-GEN unit (X49 1110-00) all shown at bottom.
- 2 Remove screws ★ from the counter unit.

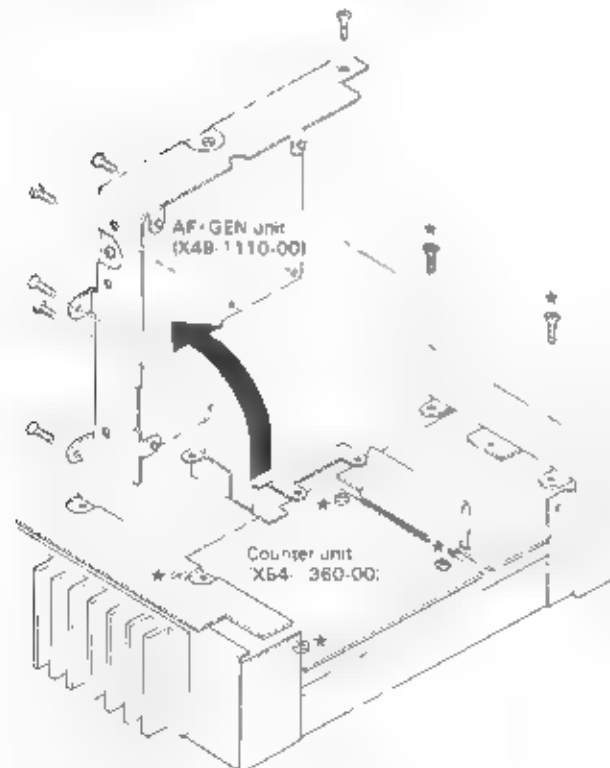


Fig. 12 Removing the counter unit

REMOVING THE FINAL UNIT

Remove Nino screws (★)

Q1 2SC2076 (V03 2075-06) Q4 2SC2290 ★ J (V03-2290-16) M type receptacle E04-0152-05
Q2 2SC2509 (V03 2509-06) Q5 2SC2290 ★ J (V03-2290-16)

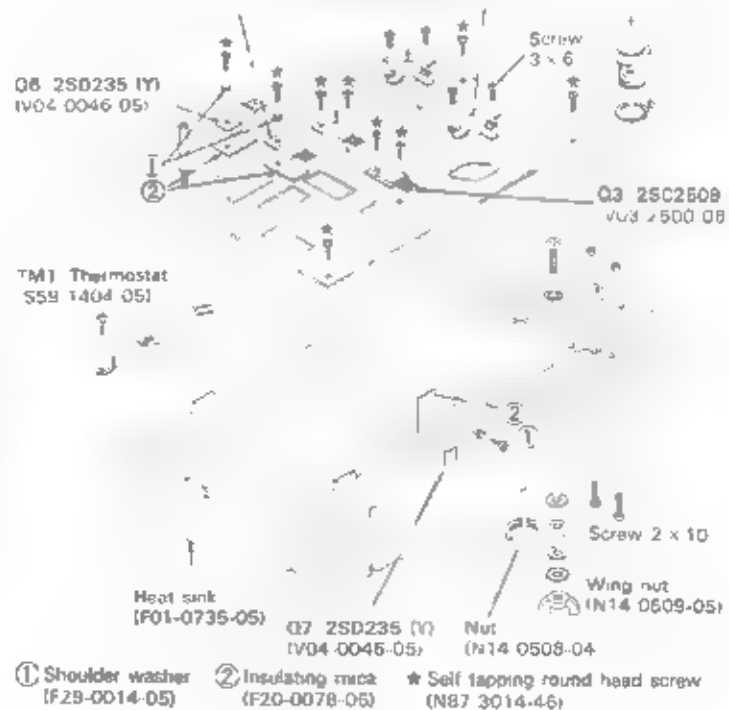
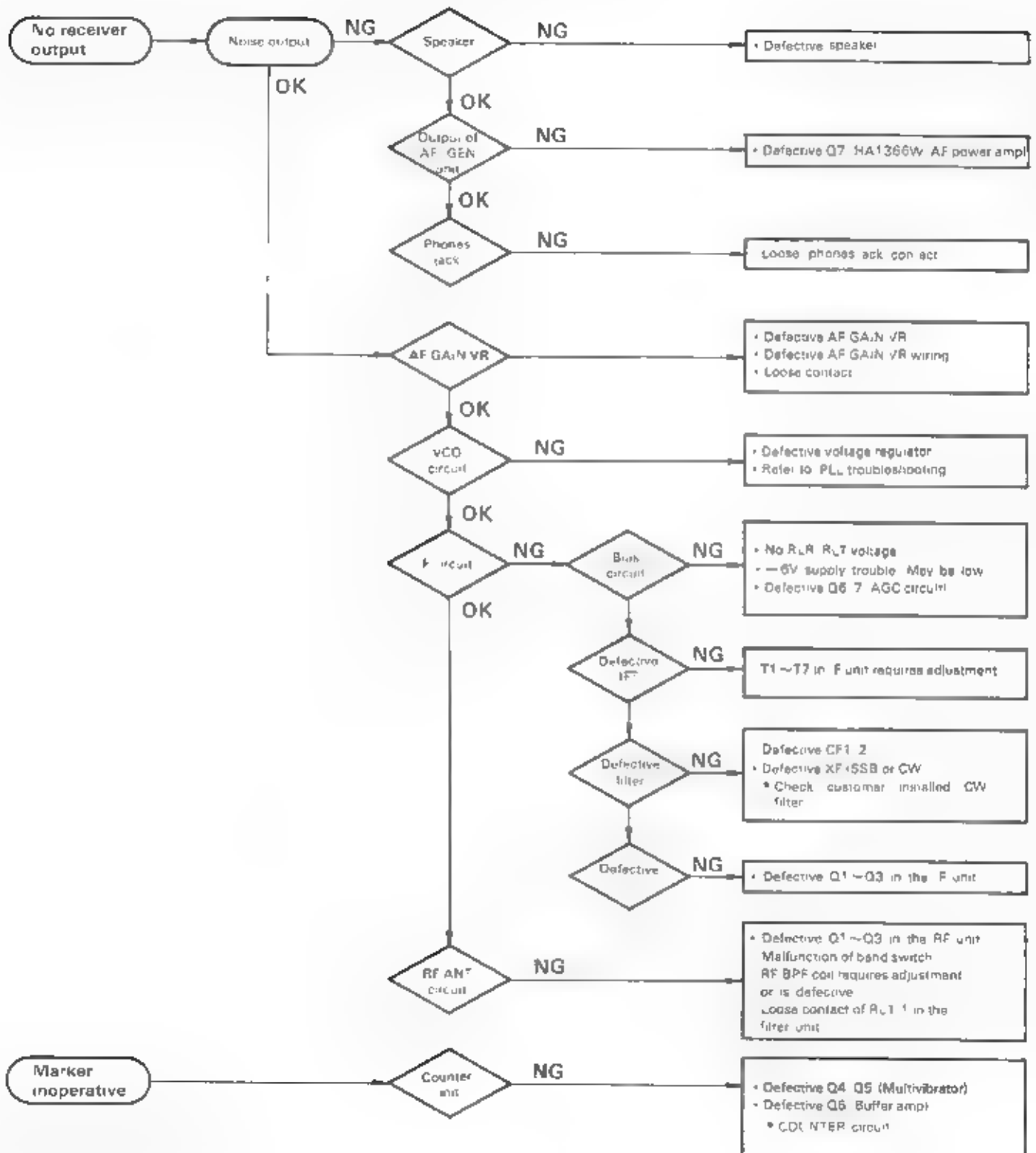


Fig. 13 Final unit disassembly

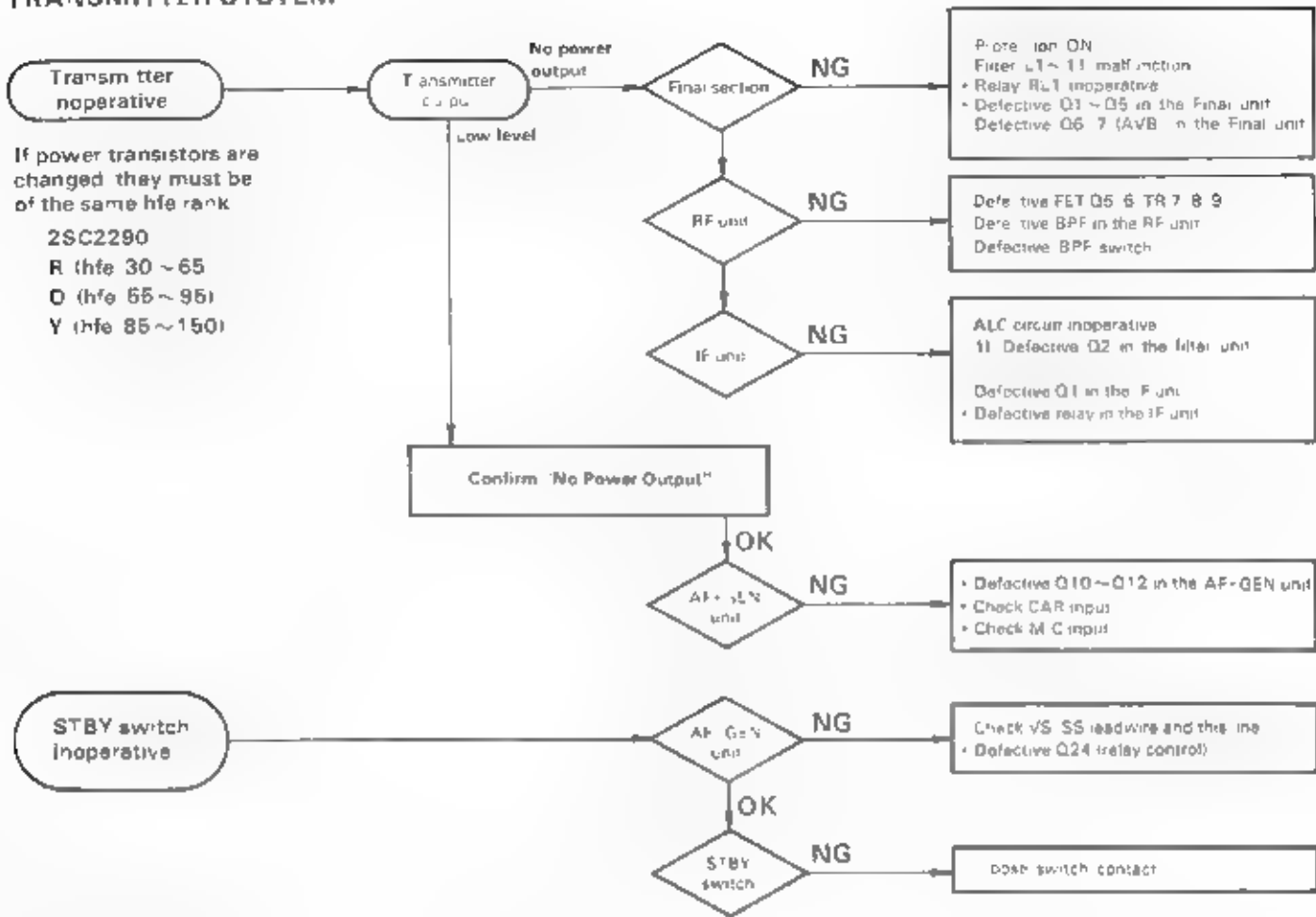
TROUBLE SHOOTING

RECEIVER SYSTEM

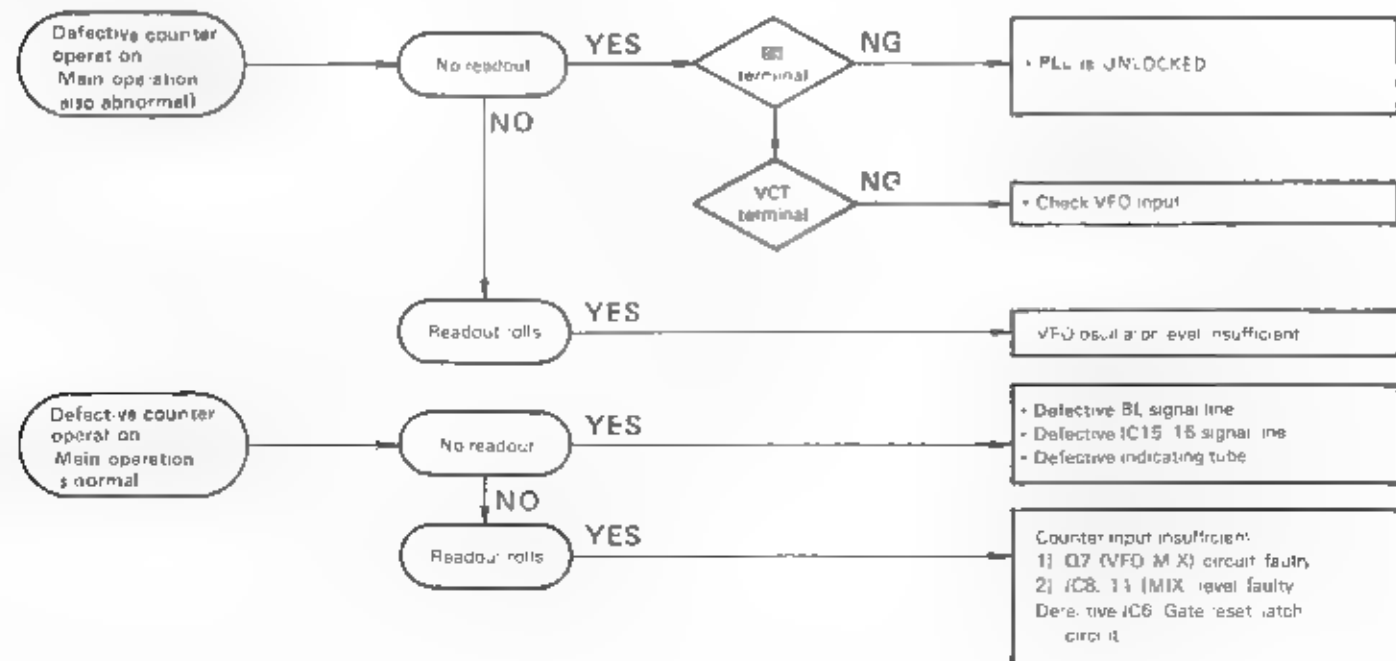


TROUBLE SHOOTING

TRANSMITTER SYSTEM

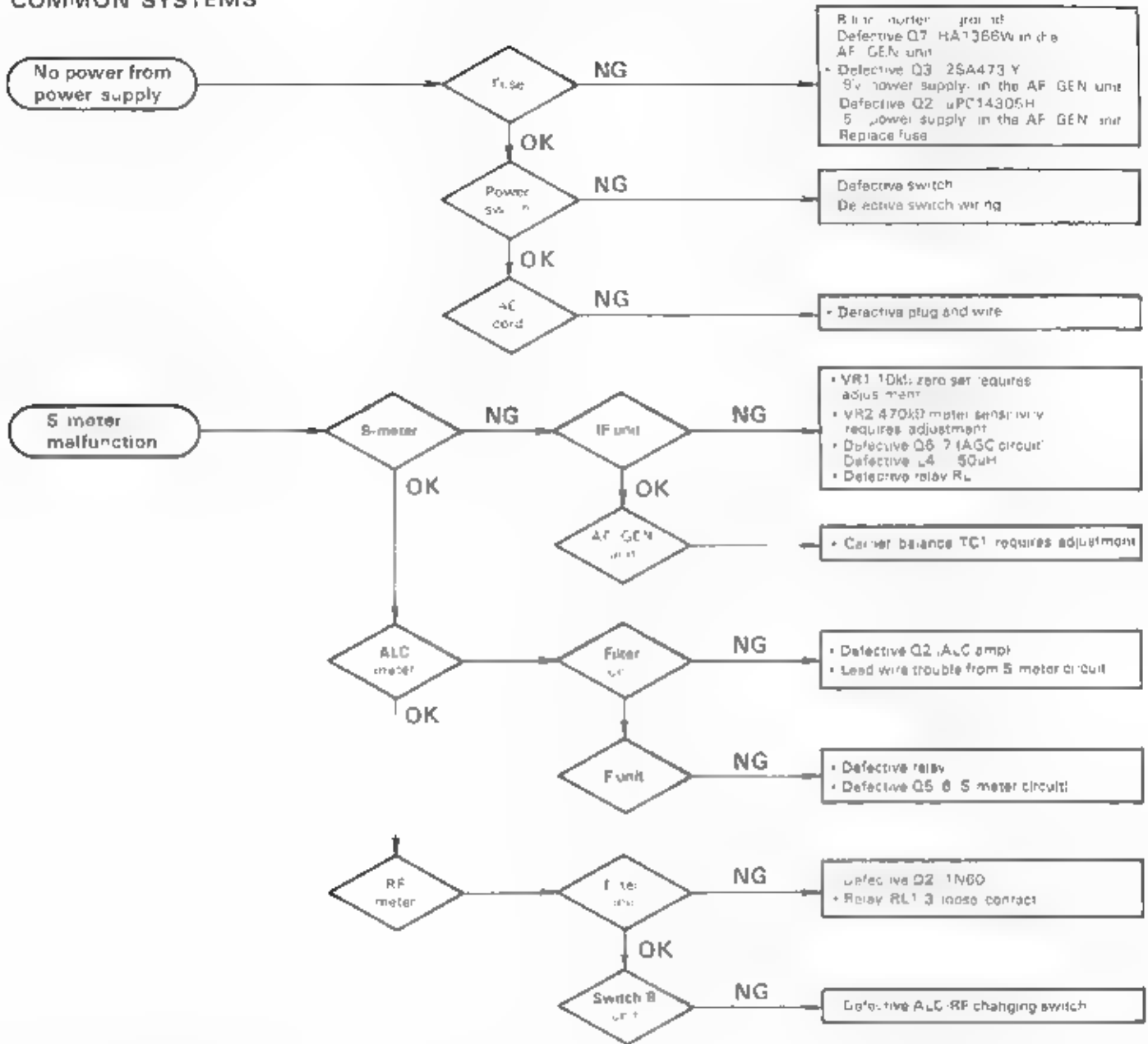


COUNTER SYSTEM

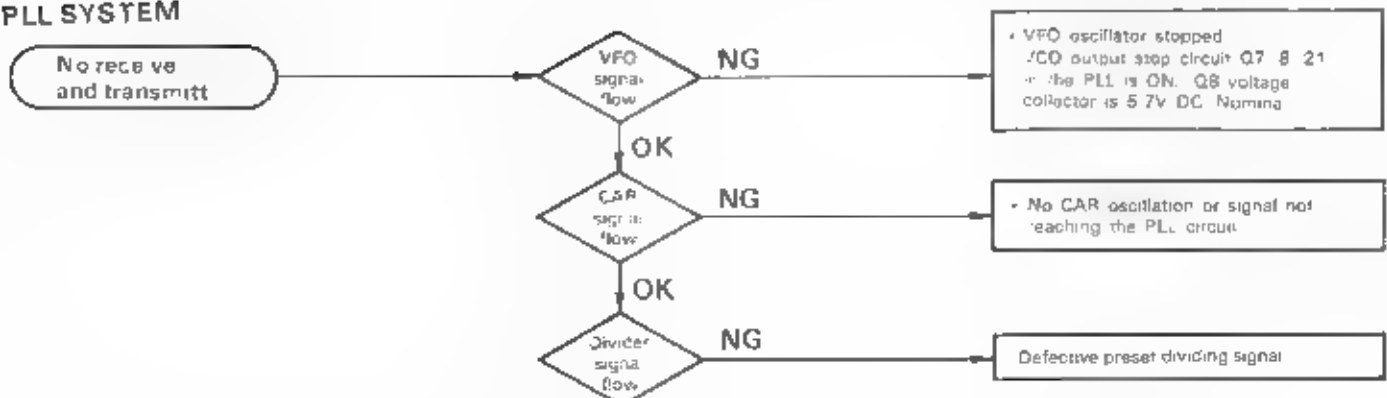


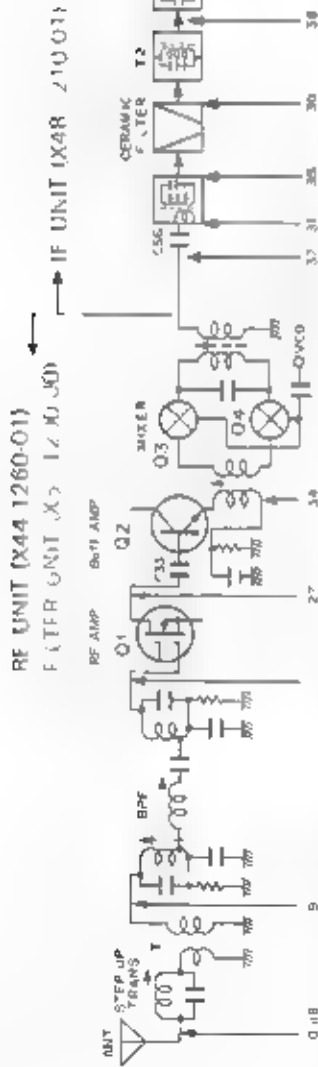
TROUBLE SHOOTING

COMMON SYSTEMS



PLL SYSTEM





FREQ ENCY 14.250 MHz
NP 0.1 B 1.5 V
AF 1.0 pT 0.3 v at 80.

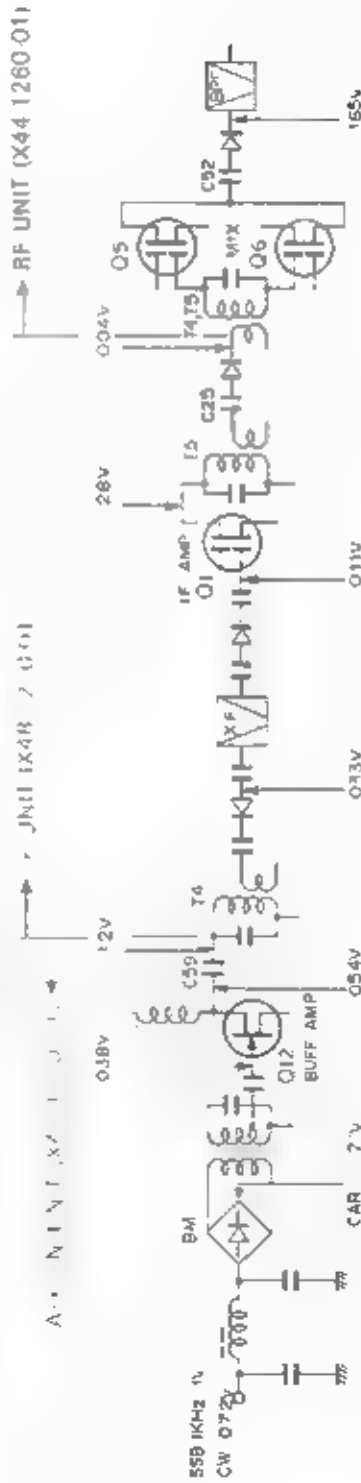
NOTES

1. The figure shows the signal generator output required for a constant audio in the AF gain control setting. Set the AF gain control for 0.63 v, 80. 50 mV audio output at 0 dB signal generator input at 4.250 MHz.
2. Measure the AF output at the ring detector on the IF unit (X48 1710).

3. All output measurements are read from an RF VTM.

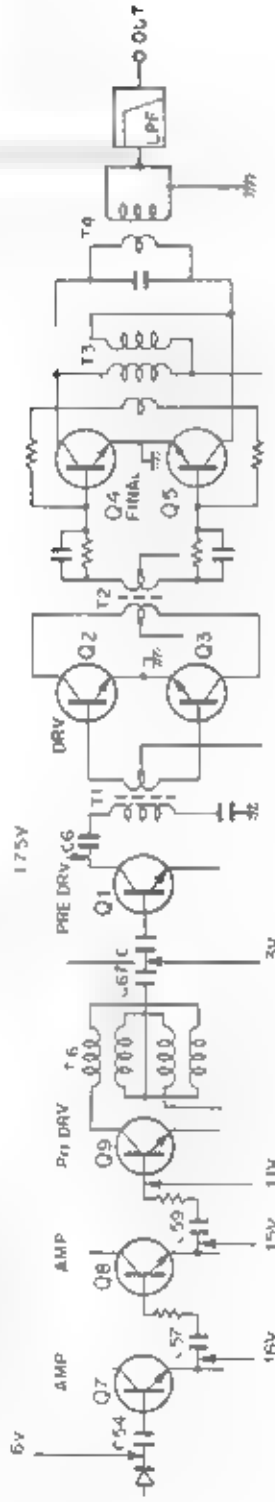
4. To measure signal generator output connect a 0.0 pF 500 W capacitor between the signal generator and the check point.

TRANSMITTER SECTION



14.25 MHz ANT. T
A.C. on full scale zone

NOTE Adjust ALC level VR for full scale reading



FINAL UNIT
(X56 1350 00)

1. 11 3 N 1
x5, 1200 00

LEVEL DIAGRAM

ADJUSTMENTS

GENERAL

Adjustment procedures for this transceiver are classified into formal adjustments requiring a full service bench and simplified adjustment using a VTVM, AF and RF VTVM, AG and AF and RF dummy load.

Complete adjustment also requires a frequency counter, SSG, sweep generator, etc.

(TX BPF, RX BPF, IF trap)

TEST EQUIPMENT REQUIRED

1 VTVM or DVM

- 1) Input resistance: More than 1 MΩ
- 2) Voltage range: 1.5 to 1000V AC/DC

NOTE

A high precision voltmeter may be used. However, accurate readings can not be obtained for high-impedance circuits.

2 RF VTVM

- 1) Input impedance: 1 MΩ and less than 3 pF min
- 2) Voltage range: 10 mV to 300 V
- 3) Frequency range: 50 MHz or greater

NOTE

During adjustment special accuracy is not required (such as input level or PLL circuit carrier oscillator output). A VTVM or VOM may substitute for an RF VTVM by measuring the output of a detector as shown in item 12.

3 AF VTVM

- 1) Frequency range: 50 Hz to 10 kHz
- 2) Input resistance: 1 MΩ or greater
- 3) Voltage range: 10 mV to 30 V

4 AF GENERATOR (AG)

- 1) Frequency range: 40 Hz to 5 kHz
- 2) Output: 2 mV~1 V, low distortion

5 AF DUMMY LOAD

- 1) Impedance: 8Ω
- 2) Dissipation: 3 W or greater

6 RF DUMMY LOAD

- 1) Impedance: 50 to 75Ω, 150Ω
- 2) Dissipation: 100W continuous or greater
- 3) Frequency limits: 1.8 to 30 MHz

The above-mentioned instruments may be used for simplified adjustment. For complete precise adjustment the following instruments are also necessary.

7 OSCILLOSCOPE

Requires high sensitivity and external synchronization capability.

8 SWEEP GENERATOR

- 1) Center frequency: 8.83 MHz
- 2) Frequency deviation: Maximum ± 5 kHz
- 3) Output voltage: More than 0.1V
- 4) Sweep rate: At least 0.5 sec/cm

9 Standard Signal Generator

- 1) Frequency range: 1.8 to 30 MHz
- 2) Output: -6 dB ~ 120 dB, 0.25 μ V ~ 0.5V

NOTE

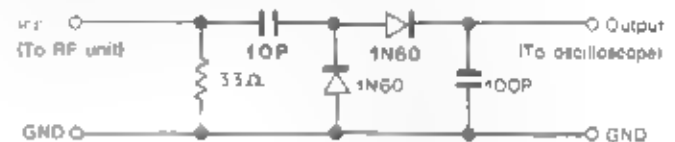
10. FREQUENCY COUNTER

- 1) Minimum input voltage: 50 mV
- 2) Frequency range: Greater than 40 MHz

11 NOISE GENERATOR

Must generate ignition noise containing harmonics beyond 30 MHz.

12 DETECTOR (TX BPF)



REFERENCE

Japanese "SSG"

- 6dB
- 0 dB
- 6 dB
- 12 dB
- 24 dB
- 30 dB
- 40 dB
- 50 dB
- 60dB
- 70 dB
- 80 dB
- 90 dB
- 100 dB
- 120 dB

American "SG"

- 0.25 μ V
- 0.5 μ V
- 1 μ V
- 2 μ V
- 8 μ V
- 15.8 μ V
- 50 μ V
- 158 μ V
- 500 μ V
- 1.58 mV
- 5 mV
- 15.8 mV
- 50 mV
- 0.5 V

ADJUSTMENTS

PREPARATORY WORK

Remove the upper and lower cases as shown in figure 14 below



Fig. 14 Case disassembly

2 Unless otherwise specified set the controls as follows


AF GAIN	COUNTERCLOCKWISE
RF GAIN	FULL CLOCKWISE
MIC GAIN	CENTERED
CAR LEVEL	CENTERED
RIT	CENTERED
IF SHIFT	CENTERED
MODE	LSB
SEND REC	REL
NB	OFF
CAL	OFF
RIT	OFF
FIX/VFO	VFO
ALC/RF	RF
VOX/MAN	MAN
POWER	ON

[illegible]

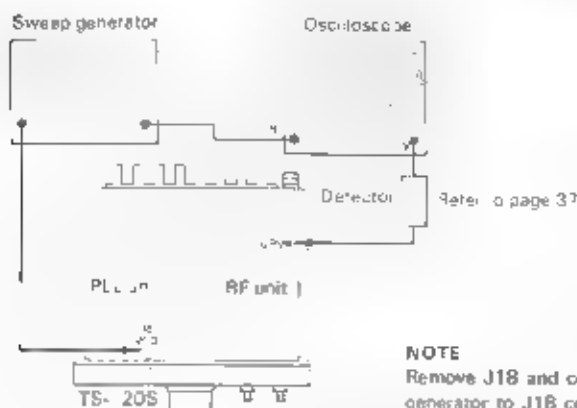
ADJUSTMENTS

Item	Condition	Measuring point			Adjust			Specifications Remarks
		Instruments	Unit	Terminal	Unit	Parts	Reference	
7 TX BPF	Main gain adjustment in 5.5 MHz 7.5 MHz, 14 MHz, 21 MHz, 28 MHz	Sweep generator Oscilloscope Detector	RF PLL	DRV VCO	RF	L3~17	Adjust coils for waveform as shown at right Fig. 15	<p>5 MHz L3 4 5 14 MHz 6 8</p> <p>Repeat ratio less than 5 dB Repeat ratio less than 2 dB</p>
8 RX BPF	This adjustment requires a spectrum analyzer and sweep- ing generator. Otherwise adjust 25 MHz term 7	Sweeping generator	RF	ANT	RF	L3~17	same as above Fig. 6	<p>Repeat ratio less than 2 dB Repeat ratio less than 1 dB</p>
9 IF AMP	1) VFO 250 BAND 4 MHz MODE USB	SSG Oscilloscope AF VTVM 8" mm or speaker		SP	RF	T3 T1 17	1) Adjust for a max. output 2) Apply SSG output at 25 MHz 6 dB to the antenna terminal signal to noise ratio about 5 dB	<p>Repeat ratio less than 2 dB Repeat ratio less than 1 dB</p>
10 IF amp	BAND 3 MHz BAND 4 MHz	SSG AF VTVM		SP	RF	1 2 L35	1) Adjust for max. output S meter reading and AF output level from the pro- cedure two of the above	<p>40 dB for 40 dB attenuation at 8 MHz 15 MHz signal Fig. 7</p>
11 NB	Carrier level generator to ANT terminal S meter reading SS~7	Carrier generator Oscilloscope	F	D 4 K (cathode)	RF IF	T3 T1	Adjust for a wave form as shown at right repeat the pro- cedure two or three times	<p>Before adjustment After adjustment</p>
12 Counter standard Oscillator	BAND WWV VFO 500 15 000 MHz CAL ON	ANT			Freq. count	TC1	Set the BAND switch to WWV dial scale 500 connect an antenna to the set While receiving WWV signal at 15 MHz adjust trimmer TC1 at the side of oscillator for zero beat between this signal and 15 MHz	Set for zero beat between WWV and CAL
13 Base current	MODE USB M.C. Counter- clockwise BAND 14 MHz SPND position	RF power meter Current meter	FINAL	D14 termi- nal to L7 150pH side 10E	FINAL	① VR1 ② VR2	150 mA 100 mA	After adjustment move the wire from D14 to L7 150pH side 2) After adjustment, resolder red wire to 3P terminal
14 Carrier suppression	Adjust 5.5 MHz for RF 5.5 W power Switch to SSB position. No input	Power meter Oscilloscope Direction coupler		ANT	AF-GEN	VR5 C2 (Min.)	Carrier level near 40 dB down from output signal	Repeat the procedure two or three times

ADJUSTMENTS/TEST SET UP

Item	Condition	Measuring point			Adjusting point			Specifications	Remarks
		Instruments	Unit	Terminal	Unit	Parts	Reference		
15. Carrier point	1. Connect AG to M C terminal and apply an input of 1500 Hz at 7 mV. 2) Adjust M C G A N until output becomes SW	RF power meter Oscilloscope AG AF VTVM		ANT	CAR	USB → TC1 LSB → TC2	Shift the AF signal between 300 Hz and 2700 Hz adjust TC1 in USB and TC2 in LSB so RF output reading is equal high and low ± 0.1	400 Hz 2500 Hz (± 0.5 dB down 1500 Hz Centered) Check carrier suppression if carrier point is adjusted Adjust TC1 in USB and TC2 in LSB so RF reading is the same	
6. Side tone	AF G A N 12 o'clock MODE CW Install KEY and KEY down	KEY AF VTVM			AF-GEN	VR4	0.63V B1		
7. IC meter	M DE SW CW STBY SW SEND Same as item 13	Power meter DC current meter			FILTER	VR4	11A	When same as item 13 2 Adjust CAR level IC meter reading to 11A	
18. ALC	BAND 14 MHz VFO 200 MODE CW VR2 in the filter Unit counter-clockwise STBY SEND	RF power meter AG AF VTVM			FILTER	VR3 VR2	95W 75W (28.5 MHz)	Check that RF output power is the same level input SSB position at 7 mV (1500 Hz) input	
19. Protection	VR1 in the filter Unit <u>Pull clock</u> Same as above Refer to 42 page	RF VTVM DC volt meter coaxial 50Ω 50V (Vx1) meter 150Ω 100W dummy		FILTER TP1 and TP2 as shown at right	FILTER	TC1	MIN (Approx) 0.2~0.4V		
10. S-meter	Adjust 14.175 MHz in receive position	SSG			1) 4F 2) 1F 3) 1F	1) VR1 2) T8 3) VR2	1) 100 dB to the antenna from SSG - S9 ± 60 dB 2) 8 dB to the antenna from SSG - S1 ± 40 dB ± 50 μV to the antenna from SSG - S9	2) Less than 8 dB ± 4 dB 3) Less than 40 dB ± 6 dB	

TEST AND ALIGNMENT SET-UP



NOTE
Remove J18 and connect the sweep generator to J18 connector (pin 1)

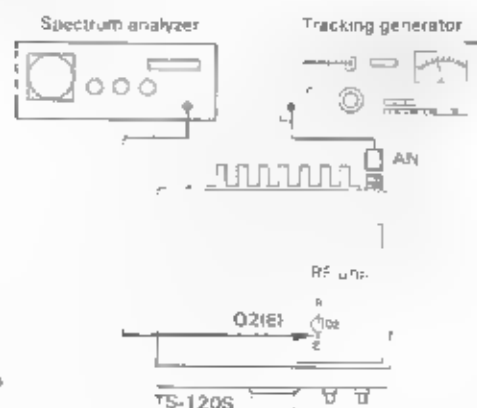


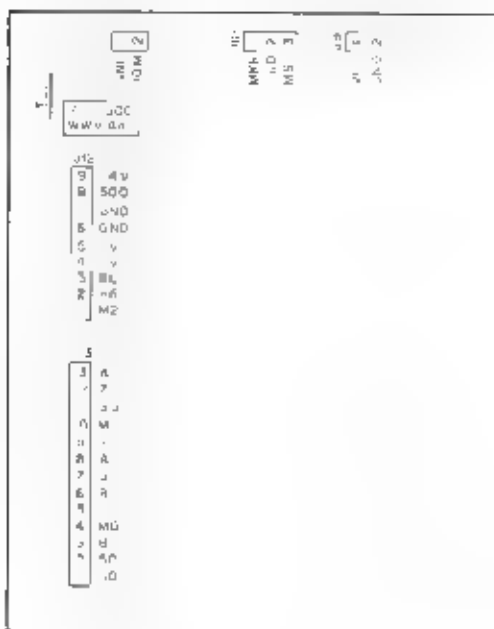
Fig 15 Test equipment connection, Item 7 TX BPF

Fig 16 Test equipment connection, item 8 RX BPF

TEST AND ALIGNMENT SET-UP

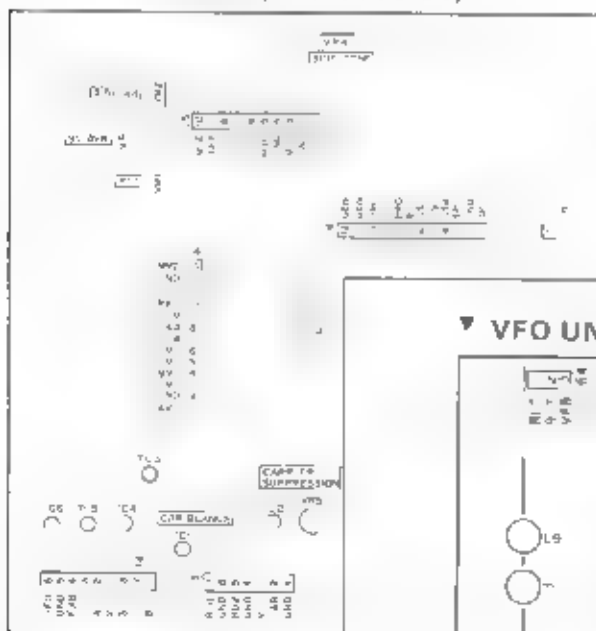
PC BOARD ALIGNMENT

▼ COUNTER UNIT (X54 1360.00)

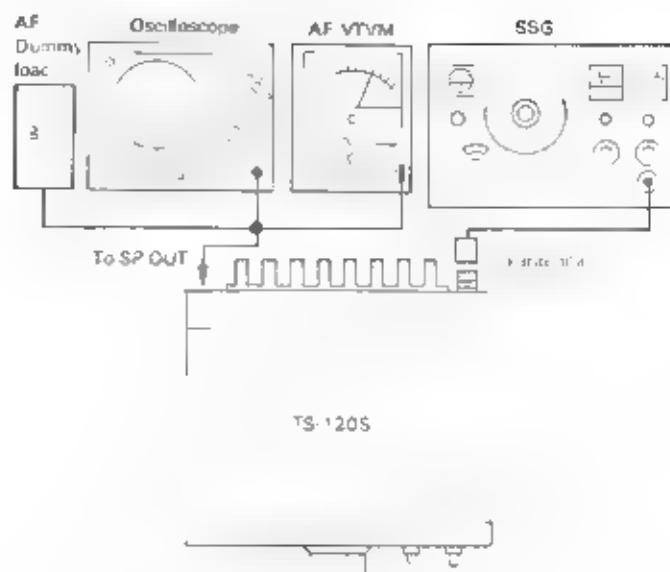
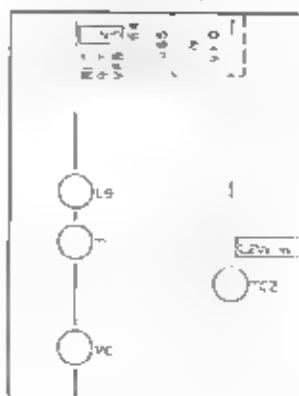


DISPLAY SECTION

▼ AF-GEN UNIT (X49-1110-01)



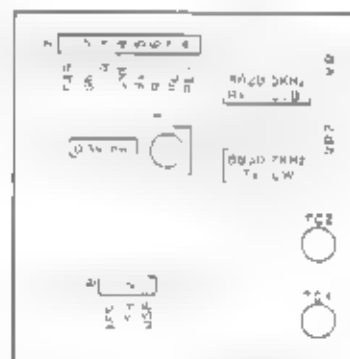
▼ VFO UNIT (X40-1130-00)



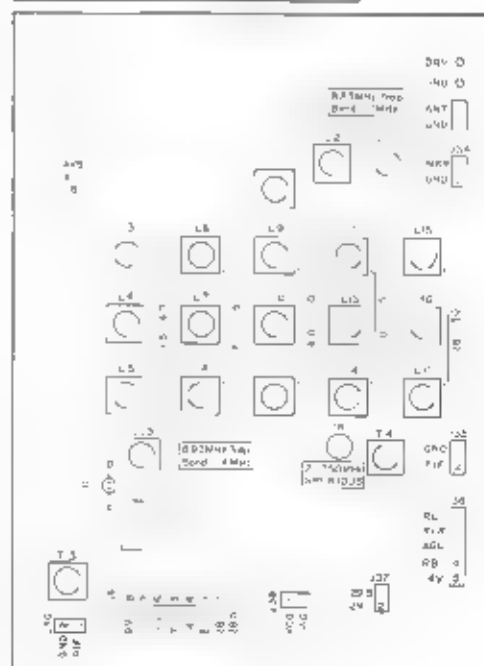
* **Caution**
NEVER TRANSMIT with 55G at antenna terminals

Fig. 17 Test equipment connection. term
9 IF AMP Item 10 IF TRAP

CAR UNIT ►
(X50-1500-00)

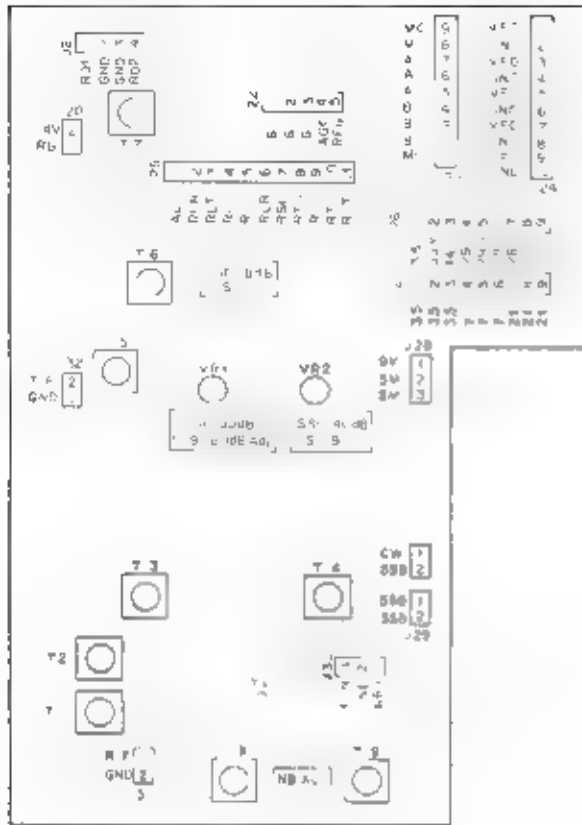


RF UNIT ▶
(X44-1260-01)

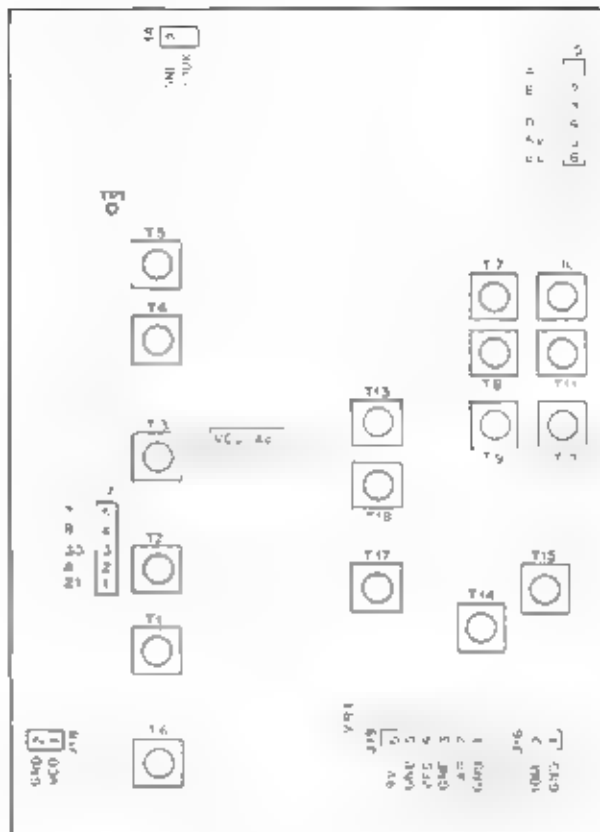


PC BOARD ALIGNMENT

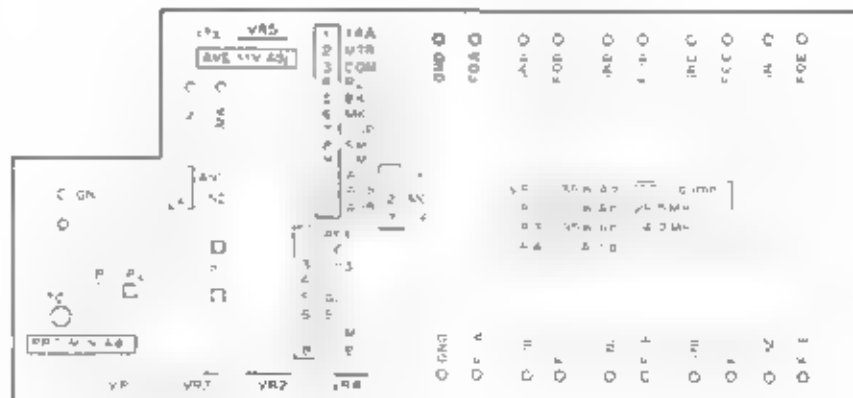
▼ IF UNIT (X48-1210-01)



PLL UNIT (X50 1490 00)



**FILTER UNIT ▶
(X51-1200-00)**



FINAL UNIT ►
(X56-1350-00)



PS-30

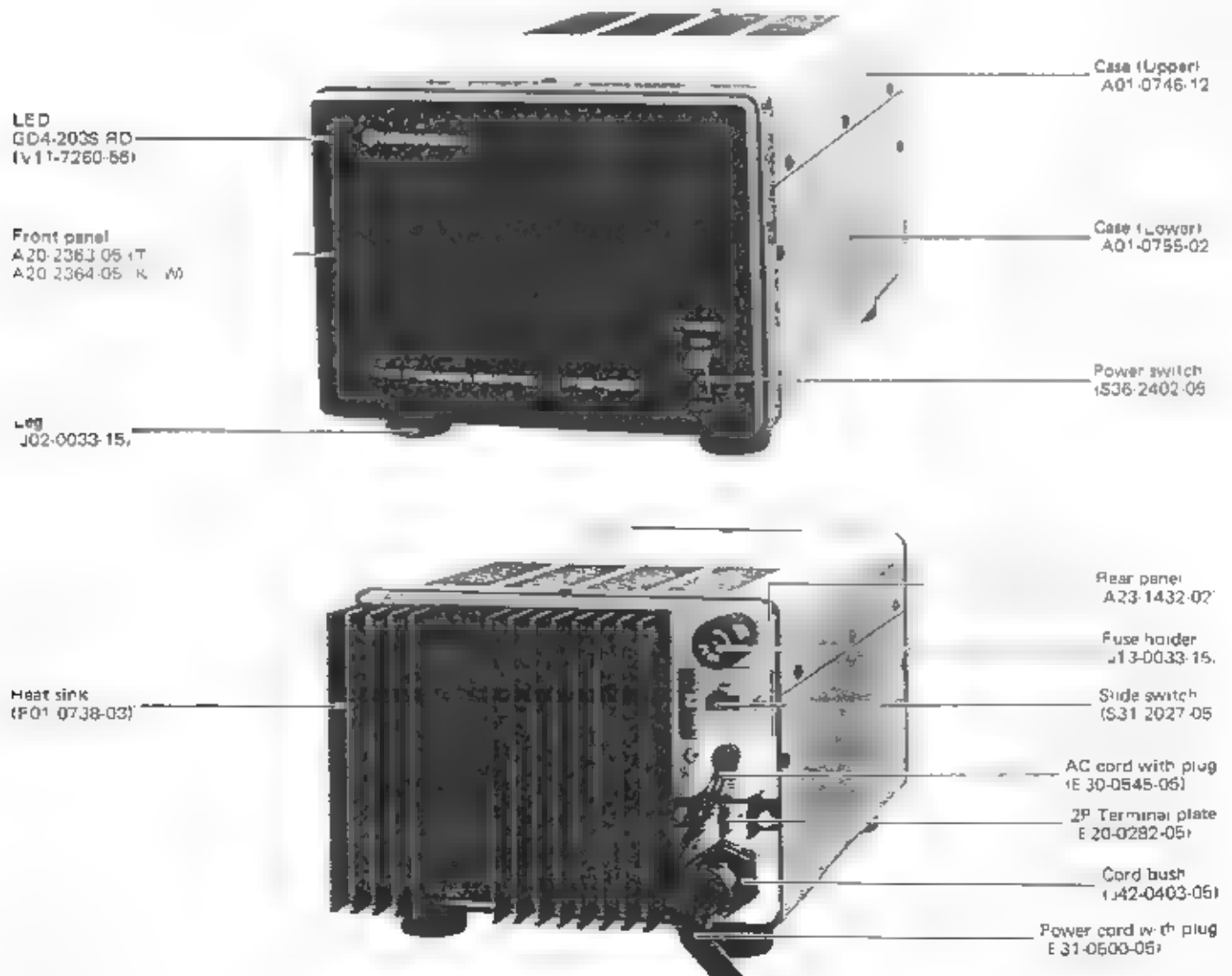
SPECIFICATION

[Power Supply Section]

Input voltage	AC 220-240V (210V, 240V $\pm 10\%$ 50/60Hz)
Output voltage	DC 3.8V (stabilized voltage)
Output current	20A (maximum) (maximum 100% duty)
Continuous load current	A maximum is recommended to be 100%
Output voltage fluctuation	When input is AC 100-220V $\pm 10\%$ $\pm 1\%$ Load regulation When input is 220V $\pm 10\%$ $\pm 1\%$ Load regulation
Ripple voltage	At load regulation: less than 10mV AC 210V $\pm 22\%$ $\pm 40\%$ At load 20mA $\pm 5\%$ in 10 seconds
Power consumption	Maximum 1.5W (3A $\times 210V$ $\times 24V$ $\times 100\%$ duty) (no load)

General

Dimensions	180.7mm \times 161mm \times 33mm (4.8" \times 2.8" \times 1.3" (D mm \times h mm))
Weight	Approx. 2.3kg (5.1 lbs)



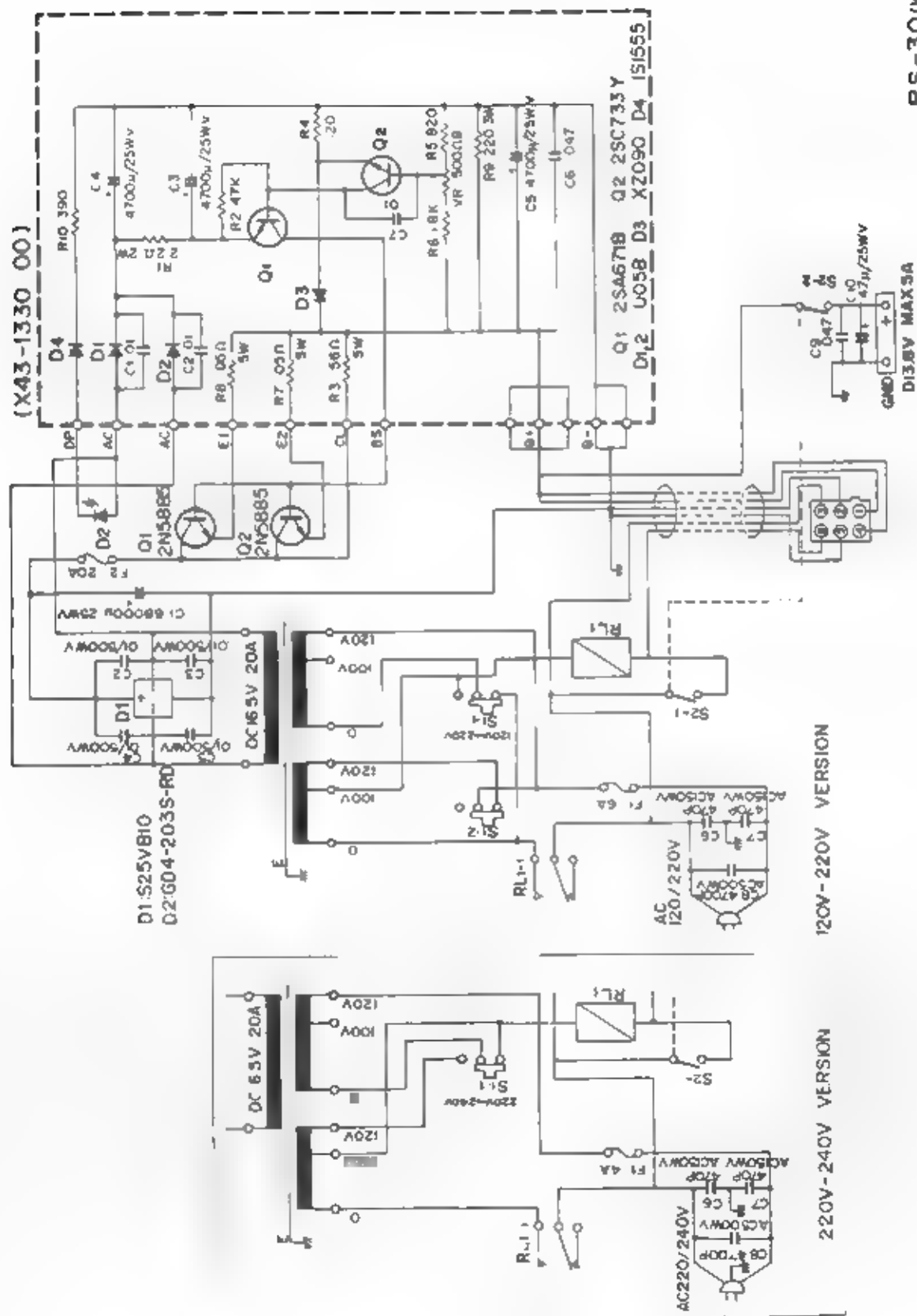
PS-30

< PS 30 PARTS LIST >

Ref. No.	Parts No.	Description	Re- marks
GENERAL			
C1	C90-0813-05	Electrolytic 6800 μ F 25VV	☆
C2 ~ 5	CK45E2H103P	Ceramic 0.01 μ F \pm 100, 0%	
C6, 7	C90-0300-05	Ceramic 470pF AC150VV	
C8	C91-0412-05	Ceramic 470pF AC500VV	
C9	CK45F-H473Z	Ceramic 0.047 μ F \pm 80% 20%	
C10	CE04W1E4R7	Electrolytic 4.7 μ F 25VV	
Q1, 2	V08-1012-05	Transistor 2N58B5	☆
D1	V11-1365-05	Diode S25V610	☆
—	V11-7260-56	LED GD4-2035-RD	☆
RL1	551-1405-05	Relay	☆
—	A01-0746-12	Case (upper)	☆
—	A01-0755-02	Case (lower)	☆
—	A20-2363-03	Front panel (T)	☆
—	A20-2364-03	Front panel (K W)	
—	A23-1432-02	Rear panel (K)	☆
—	A23-1433-02	Rear panel (W T)	
—	B46-0058-00	Warranty card	
—	B50-2652-00	Operating manual (K W)	
—	B50-2656-00	Operating manual (T)	
—	E20-0282-05	2P Terminal plate	
—	E22-0207-05	Lug plate x 3	
—	E30-0546-05	AC cord with plug	
—	E31-0500-05	Power cord with plug	☆
—	F01-0738-03	Heat sink	☆
—	F05-2035-05	Fuse 2A	☆
—	F05-802-05	Fuse 6A \times 2 K	
—	F06-4022-05	Fuse 4A (W T)	
—	H01-2623-04	Carton case (inside)	☆
—	H10-2623-02	Styren foam cushion (F)	☆
—	H10-2624-02	Styren foam cushion (R)	☆
—	H12-0456-04	Cushion	☆
—	H20-1413-03	Protection cover	☆
—	H25-0029-04	Protection bag 180 \times 110mm	
—	J02-0049-14	Lug x 6	
—	J13-0032-15	Use holder	
—	J19-0509-04	LED holder	
—	J32-030-14	00000 \times 2	
—	J41-0006-5	Cord bush (K)	
—	J4-0024-15	Cord bush (W T)	
—	J42-0403-05	Cord bush	
—	J6-0019-05	Vinyle tie x 7	
—	L01-8066-16	Power transformer	
—	X43-330-00	AVR Unit	
—	S3-2027-05	Slide switch	
—	S36-2402-05	Power switch	☆

Ref. No.	Parts No.	Description	Re- marks
AVR UNIT (X43-330-00)			
C1, 2	CK45F1H103Z	Ceramic 0.01 μ F \pm 80% - 20%	
C3 ~ 5	C90-0814-05	Electrolytic 4700 μ F 25VV	☆
C6	CK45F1H473Z	Ceramic 0.047 μ F \pm 80% 20%	
C7	CK45F1H103Z	Ceramic 0.01 μ F \pm 80% - 20%	
R2 ~ 10	RD148B2E000J	Carbon resistor 000 Ω \pm 5% 1/4W	
R1	RS14G8302R2J	Resistor (Metal film) 2.2 Ω \pm 5% 2W	
R3	R92-0622-05	Resistor (cement) 56 Ω 5W	
R7, 8	R92-0619-05	Resistor (cement) 60m Ω 5W	
R9	RS14G83F221J	Resistor (metal film) 220 Ω \pm 5% 3W	
Q1	V0-139-05	Transistor 2SA871-D8	
Q2	V03-0183-05	Transistor 2SC733-Y	
Q1, 2	V11-0270-05	Diode U058	
D3	V11-4167-05	Zener diode XZ-080	
D4	V11-0076-05	Diode 1S1555	
VR1	R12-0042-05	Potentiometer 500 Ω B	

PS-30



VFO-120 FEATURES/BLOCK DIAGRAM/SPECIFICATIONS/EXTERNAL VIEW/INTERNAL VIEW

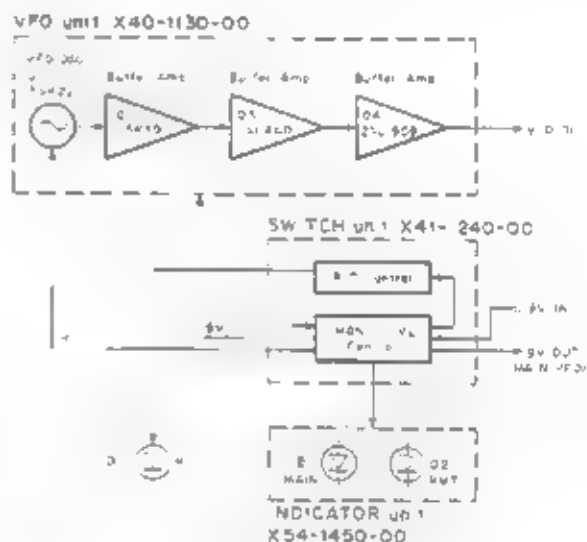
FEATURES

- 1 The model VFO-120 is a remote VFO designed to use with the TS-20S VSSB transceiver for monitoring cross-channel transceive operation.
- 2 The VFO-120 matches the TS-20S VSSB design and appearance. Its mounting plate is a standard size.
- 3 The FET oscillator circuit assures high stability and distortion-free output.
- 4 The combination of precision anti-backlash gear and a linear variable capacitor allows accurate frequency reading. Calibration is at 1 kHz intervals from 1.0 to 24 kHz. The indexed main knob is non-slip and anti-rattle.
- 5 The RT circuit allows independent receive frequency adjustment without disturbing the main tuning.
- 6 Transmit frequency can be easily changed by simply pressing the T/F switch without the need for a T/F switch. The VFO is placed in transmit mode during reception.
- 7 LED's are used as VFO and RT indicators to indicate proper operation.
- 8 The VFO-120 connects easily to the remote control unit TS-20S V.
- 9 The VFO-120 is powered by simply connecting to the supplied VFO and ground cables. The VFO cable carries the output power and control line.

SPECIFICATIONS

Oscillator frequency	500 ~ 600 MHz
Oscillator circuit	Clapp
Output voltage	2.4 V rms across 470Ω load
Frequency stability	Within 10 Hz per 30 minutes after 2 hours warm up at room temperature
Solid-state complement	NE-2 Transistor Diode Capacitor
Power source	From TS-20S V
Dimensions	250 (9 7/8) W x 90 (3 5/8) H x 235 (9 1/4) D mm (inch) 2.5 kg (5.5 lb)
Weight	2.5 kg (5.5 lb)
	* See the block diagram for change for improvement without change.

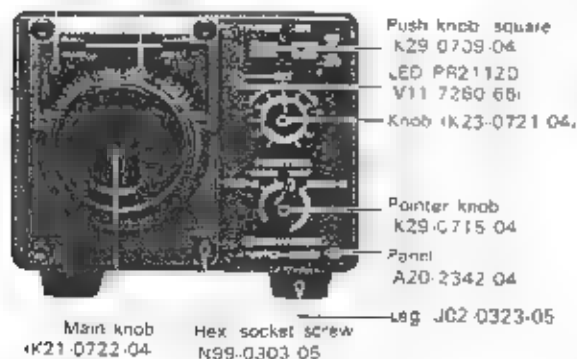
BLOCK DIAGRAM



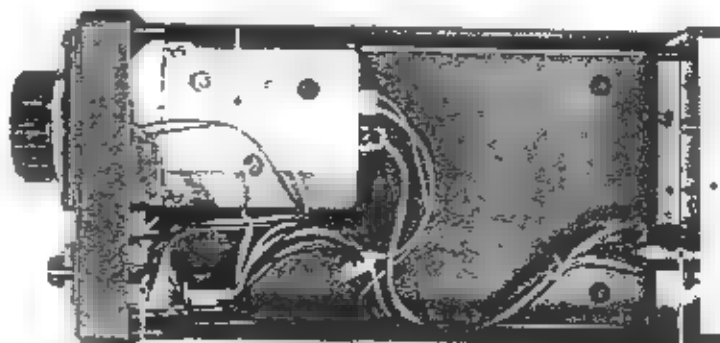
EXTERNAL/INTERNAL VIEW

Front glass (A) B-0620-04

Dial scale (A) B20-Q8 Q-04



VFO assembly unit (X60-1070-00)



Switch unit X41-1240-00

8P DIN socket E06-0852-05

Mark denotes New Part

VFO-120 PARTS LIST

Ref No	Parts No	Description	Re- marks
General			
-	A01-0739-03	Case A1 upper	☆
-	A01-0740-03	Case B lower	☆
-	A20-234-04	Panel	☆
-	A23-1430-04	Rear panel	☆
-	B39-0407-04	Spacer x 2 for leg	
-	B46-0058-00	Warranty card	(K)
-	B50-2633-00	Operating manual	(K) (W) ☆
-	B50-2634-00	Operating manual	(T)
-	E02-0107-05	Diode socket	☆
-	E06-0862-05	8P DIN socket	☆
-	E30-1628-05	VFO cable	☆
-	H0-2609-04	Carton	(K) (W) ☆
-	H01-2610-02	Carton	(T)
-	H10-2513-02	Front packing fixture	
-	H10-2514-02	Rear packing fixture	
-	H12-0445-04	Cushion	
-	H20-1407-03	Protective cover	
-	H25-0117-04	Polyethylene bag 80 x 250	
-	J02-0323-05	Leg x 4	
-	J02-0409-04	Assistance leg	
-	J42-0412-04	Knob bush	☆
-	J6-00-9-05	VFO cable 5	
-	K23-0721-04	Knob (RT)	☆
-	X29-0715-04	Pointer knob (FUNCTION)	☆
-	X29-0709-04	Push knob (square)	
-	N99-0303-05	Hex socket screw x 4 (VFO M4 x 10)	
D1	V11-7280-86	LED PR21120	
-	X41-1240-00	Switch unit	☆
-	X60-1070-01	VFO ass'y unit	☆
SWITCH UNIT (X41-1240-00)			
CAPACITOR			
C1	CK45F1H103Z	Ceramic	
POTENTIOMETER SWITCH			
VR1	R0-2404-05	5k, 10° RT	
VR2	R2-3025-05	OK1° B	
S1	S29-1410-05	Slide rotary switch SRG R4	
S2	S40-2409-15	Push switch T F SET SW	
S3	S40-2404-05	Push switch RT SW	
RELAY SEMICONDUCTOR			
RL	S51-2408-05	Relay G2V 2	
D	V-02-9-05	Diode V065	
VFO ASS'Y UNIT (X60-1070-00)			
GENERAL			
-	B01-062-05	Digital scale	
-	B0-0620-04	Front glass A1	
-	B20-0810-04	Dial scale A1	
-	B20-0811-04	Dial scale B1	
-	B30-0808-05	Pilot lamp	
-	K21-0722-04	Main knob	
-	N-9-0608-04	Washer x 2	

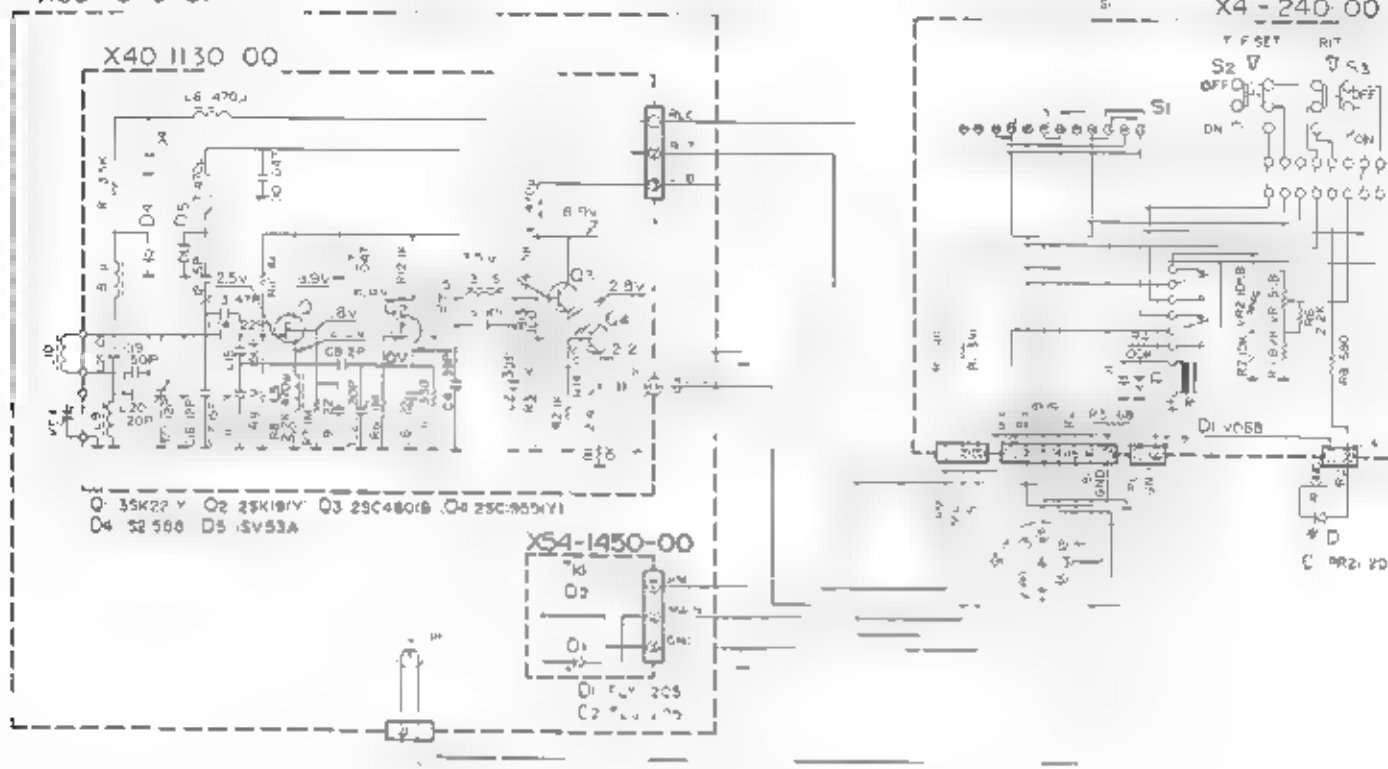
Ref No	Parts No	Description	Re- marks
-	X40-1130-00	VFO unit	
-	X54-1450-00	Indicator unit	
VFO UNIT (X40-1130-00)			
CAPACITOR			
C1	CK45F1H103Z	Ceramic	0.01μF ± 80 - 20%
C2	CC45SL1H390J	Ceramic	39pF ± 5%
C3	CC45CH1H1000	Ceramic	10pF ± 0.5pF
C4	CC45SL1H390J	Ceramic	39pF ± 5%
C5	CK4581H102K	Ceramic	1000pF ± 0%
C6	CK45F1H223Z	Ceramic	0.022μF ± 80 - 20%
C7	C90-0262-05	Ceramic	0.047μF 25V/V
C8	CC45CH1H020C	Ceramic	2pF ± 0.25pF
C9	CK45F1H223Z	Ceramic	0.022μF ± 80 - 20%
C10-11	C90-0262-05	Ceramic	0.047μF 25V/V
C12	CC45SG1H050C	Ceramic	5pF ± 0.25pF
C13	CC45LG1H470J	Ceramic	47pF ± 5%
C14	CC45LG1H220J	Ceramic	22pF ± 5%
C15-16	CC45LG1H151J	Ceramic	150pF ± 5%
C17	CC45SG1H150J	Ceramic	15pF ± 5%
C18	CC45RG1H120J	Ceramic	12pF ± 5%
C19	CC45LG1H151J	Ceramic	150pF ± 5%
C20	CC45CG1H121J	Ceramic	120pF ± 5%
C21	CK45F1H103Z	Ceramic	0.01μF ± 80 - 20%
RESISTOR			
R1-12	RC14-82%	Carbon resistor	1/4 ± 5% 1/4W
SEMICONDUCTOR			
Q1	V09-0020-06	FET	3SK22 (Y)
Q2	V09-0011-05	FET	2SK19 (Y)
Q3	V03-0079-05	Transistor	2SC460 (B)
Q4	V03-1959-06	Transistor	2SC1959 (Y)
D4	V11-0414-05	Diode	1S2588
D5	V11-4161-38	Varicap diode	1SV53A
TRIMMER/VC/INDUCTOR COIL			
TC1	IC05-0305-05	Ceramic trimmer	12pF
TC2	IC05-0013-15	Ceramic trimmer	20pF
-	IC02-0010-05	variable capacitor	
L1-2	L40-4711-03	Ferrite inductor	470μH
L3	L40-1501-03	Ferrite inductor	15μF
L5-7	L40-4711-03	Ferrite inductor	470μH
L8	L33-0025-05	Choke coil	1μH
L9	L32-0609-05	Oscillator coil B	
L10	L32-0608-05	Oscillator coil A	
MISCELLANEOUS			
-	B42-1645-04	Indication tape	
-	D22-0405-04	Coupling	
-	D40-0604-05	Dial mechanism	
-	E13-0163-05	1P Pin jack	
-	E23-0046-04	Terminal (square) x 4	
INDICATOR UNIT (X54-1450-00)			
SEMICONDUCTOR			
D1	V11-3163-16	LED	TLV-205
D2	V11-3162-86	LED	TLG-205

SCHEMATIC DIAGRAM/SPECIFICATIONS/PARTS LIST

NOTE The circuit and ratings may change without notice due to developments in technology

VFO-120 SCHEMATIC DIAGRAM

X60-070-01



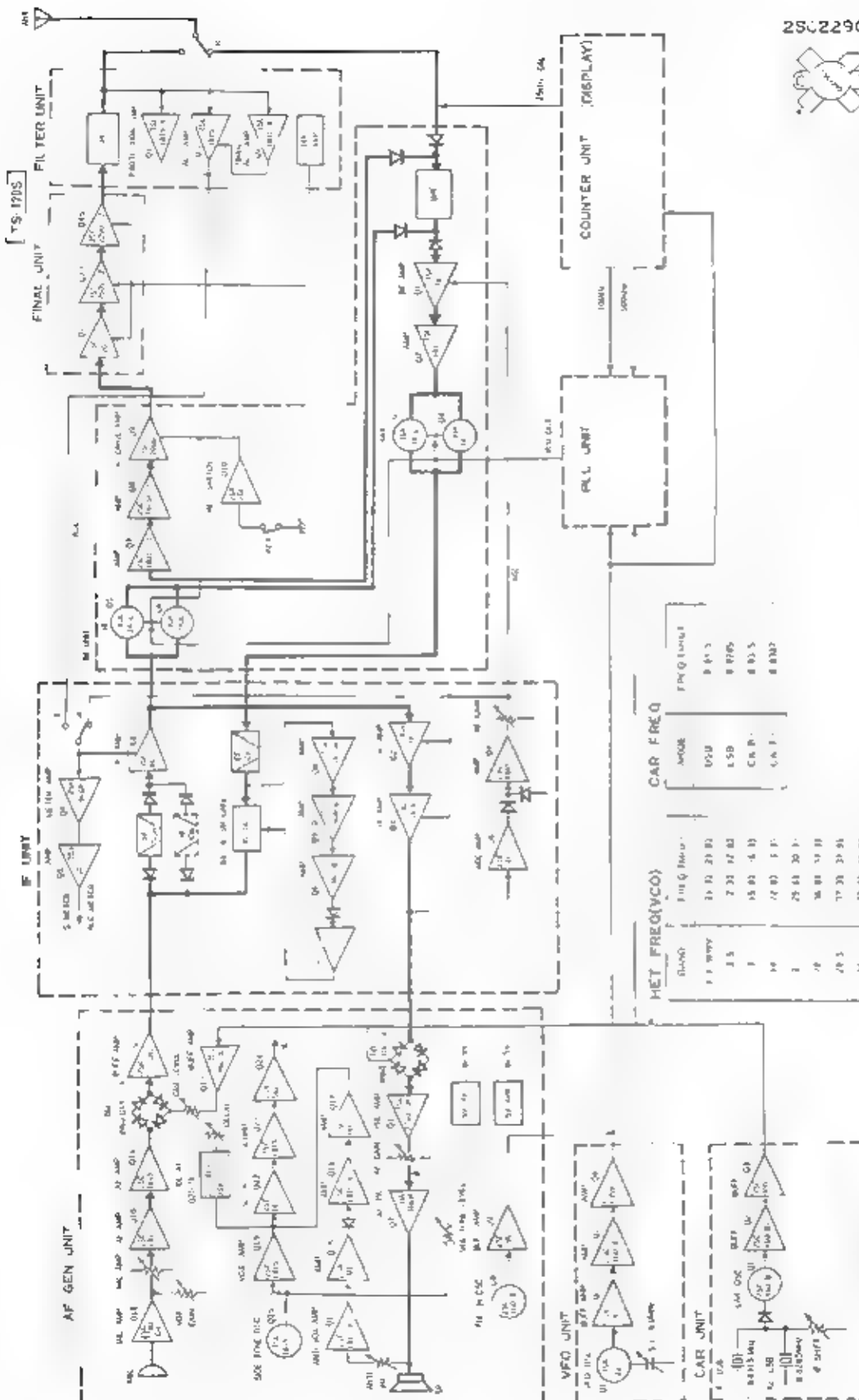
VFO-120 SPECIFICATIONS

Speaker size	3
Rated input	10 watts
Impedance	8 ohms
Frequency response	300 Hz to 5 kHz
Dimensions	4 7/8" wide x 3 3/4" high x 9 1/3" deep
Weight	excluding feet: 3.1 lbs

SP-120 PARTS LIST

Ref No	Parts No	Description	Re- marks
-	A01-0739-03	Case (A)	☆
-	A01-0740-03	Case (B)	☆
-	A20-2343-03	Panel	☆
-	A23-1431-04	Rear panel	☆
-	B04-0401-04	SP grill	☆
-	B07-0613-04	SP ring	☆
-	B39-0407-04	Spacer x 2	☆
-	B50-2636-00	Operating manual	(K) (W) ☆
-	B50-2637-00	Operating manual	(T) ☆
-	E20-0208-04	Terminal plate	☆
-	G53-0507-04	Packing x 4	☆
-	H01-2611-04	Carton	☆
-	H10-2513-02	Front packing fixture	☆
-	H10-2514-02	Rear packing fixture	☆
-	H12-0445-04	Cushion	☆
-	H20-1407-03	Protective cover	☆
-	H25-0077-03	Polyethylene bag	☆
-	J02-0323-05	Leg x 4	☆
-	J02-0409-04	Assistance leg	☆
-	J21-1144-14	Speaker mounting hardware x 2	☆
-	J61-0019-05	Vinyle tie	☆
-	T07-0204-05	Speaker	☆

BLOCK DIAGRAM



VFO-120 FEATURES/BLOCK DIAGRAM/EXTERNAL VIEW/INTERNAL VIEW/CIRCUIT DESCRIPTION

FEATURES

- 1 The AT 120 is a high performance HF antenna tuner and is a modification of the popular AT 200 antenna tuner. The AT 120 is small and light and is suitable not only for operation in your HAM shack but also for mobile or field operation.
- 2 The AT 120 is designed to be used on all Amateur bands meter and an antenna switch.
- 3 The AT-120 is designed to be used on the Amateur bands between 3.5 MHz and 30 MHz.
- 4 Antenna MATCHING or THROUGH operation is BAND switch selected.
- 5 The SWR meter operates in both THROUGH and MATCHING modes.
- 6 A mounting bracket is included for mobile operation.
- 7 The panel meter can be illuminated by an external power source.
- 8 The antenna matching circuit is effective in reducing TV since it acts as a band pass filter.

CIRCUIT DESCRIPTION

Directional Coupler

The directional coupler samples forward and reflected power from the transceiver to the load.

Meter Circuit

The forward and reflected power sampled by the directional coupler is used for SWR measurement. Forward power is calibrated with the CAL control so the meter reads relative power as SWR.

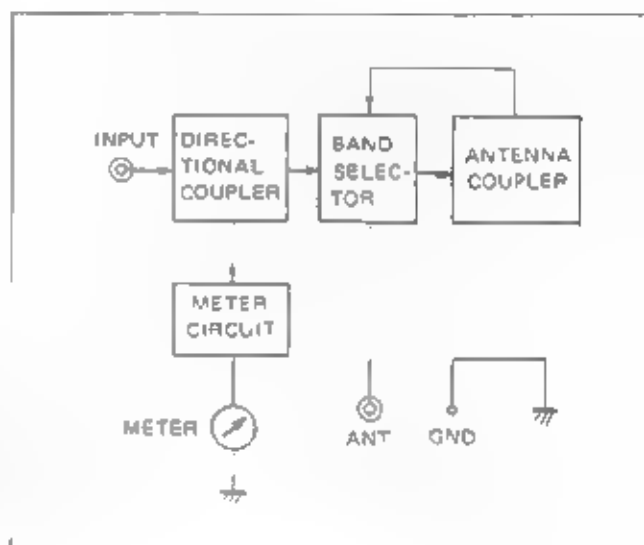
Band Selector Switch

This selects the band to which the matching circuit is tuned in the "THROUGH" position the antenna is connected directly to the transceiver by passing the coupler while still allowing SWR measurement.

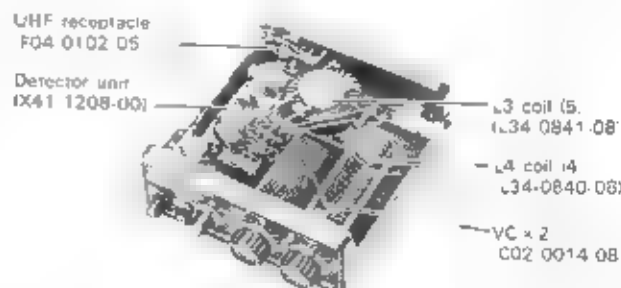
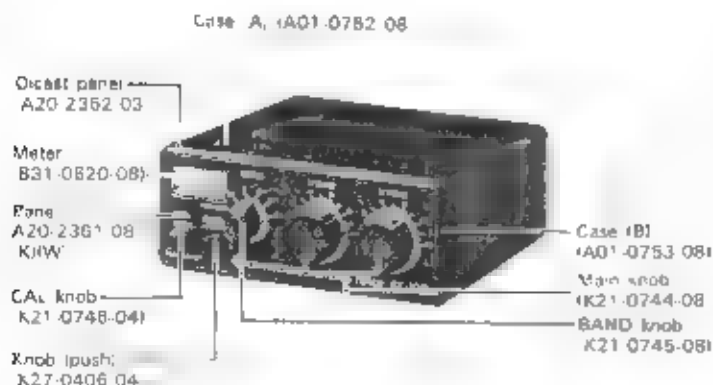
Antenna Coupler

The universal matching circuit is capable of matching 20 to 300Ω loads to the 50Ω input impedance.

BLOCK DIAGRAM



EXTERNAL VIEW/INTERNAL VIEW



AT-120 PARTS LIST/MB-100

Mark New Parts

Ref No	Parts No.	Description	Re- marks
GENERAL			
-	A01 0752-08	Case (A)	-
-	A01 0753-08	Case (B)	☆
-	A20 2360-08	Panel (T)	☆
-	A20 236 08	Panel (K) (W)	☆
-	A20 2362-03	Dicasting panel	☆
-	B31 0820-08	Meter	☆
-	B31 0058-00	Warranty card (K)	-
-	B50 2887-08	Operating manual (K) (W) (T)	☆
-	B51 0876-00	Service manual (K) (W) (T)	☆
-	D23-0061 04	Seaming	-
-	E04-0102 05	JMF receptacle x 2	-
-	E08-0203 25	2P socket	-
-	E09-0203 25	2P plug	-
-	E23-0015-04	Earth lug x 3	-
-	J02-0089-05	Foot	-
-	J29-0402 08	Mobile mount	-
-	J42 0401 04	Knob bush	-
-	K21 0744-08	Knob x 2 R.X.TUNE	☆
-	K21 0745-08	Knob BAND	☆
-	K21 0746-04	Knob CALL	-
-	K27 0408-04	Knob PLUSH	-
COIL			
3	L34-0841-08	Coil (5)	☆
4	L34-0840-08	Coil (4)	☆
5	L34-0849-08	Coil (6)	-
SWITCH			
-	S01 3404 08	Rotary switch	-
-	S40 2403 05	Push Switch	-
VC POTENTIOMETER			
C1 2	C02-0014-08	Variable capacitor x 2 250pF 1KV	-
-	R05 3408-05	Variable resistor 20 KΩ (B)	☆
CAPACITOR			
1 2 3 4	Not used		-
5	CK45F1H104Z	Ceramic 0.1μF +80% -20%	-
6	CM93B2H250J	Mica 25pF ±5%	-
7	CM93B2H171J	Mica 170pF ±5%	-
8	CM93B2H101J	Mica 100pF ±5%	-
9	CM93B2H201J	Mica 200pF ±5%	-
10	CM93B2H341J	Mica 340pF ±5%	-
11	CM93B2H951J	Mica 950pF ±5%	-
12 13	CK45F H104Z	Ceramic 0.1μF +80% -20%	-
MISCELLANEOUS			
-	N09 0007 05	Wing nut x 4 M5 x 8	-
-	N14 0509-05	Wing nut	-
-	X41 1208-00	Detector Unit	☆
-	H01 2633-08	Carton (T)	☆
-	H01 2634-08	Carton (K) (W)	☆
-	H12 0461-08	Cushion	☆

DETECTOR UNIT (X41-1208-00)

Ref No	Parts No	Description	Re- marks
C1.2	CM93B2H150J	Mica 15pF +5%	
C3.4	CK45F1H104Z	Ceramic 0.1μF +80% -20%	
R1.2	PD14882E510J	Carbon resistor 51Ω +5% 1/4W	
L1.2	L39-0403-08	Detector coil	☆

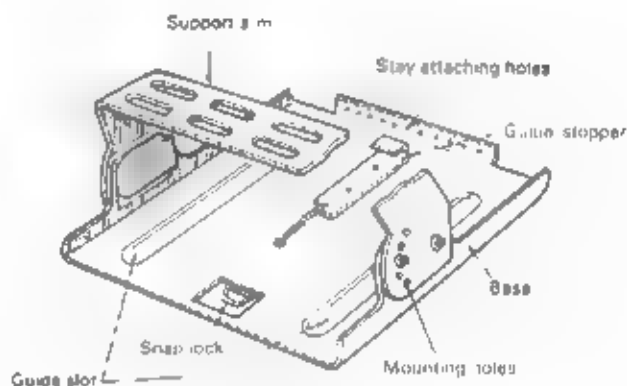


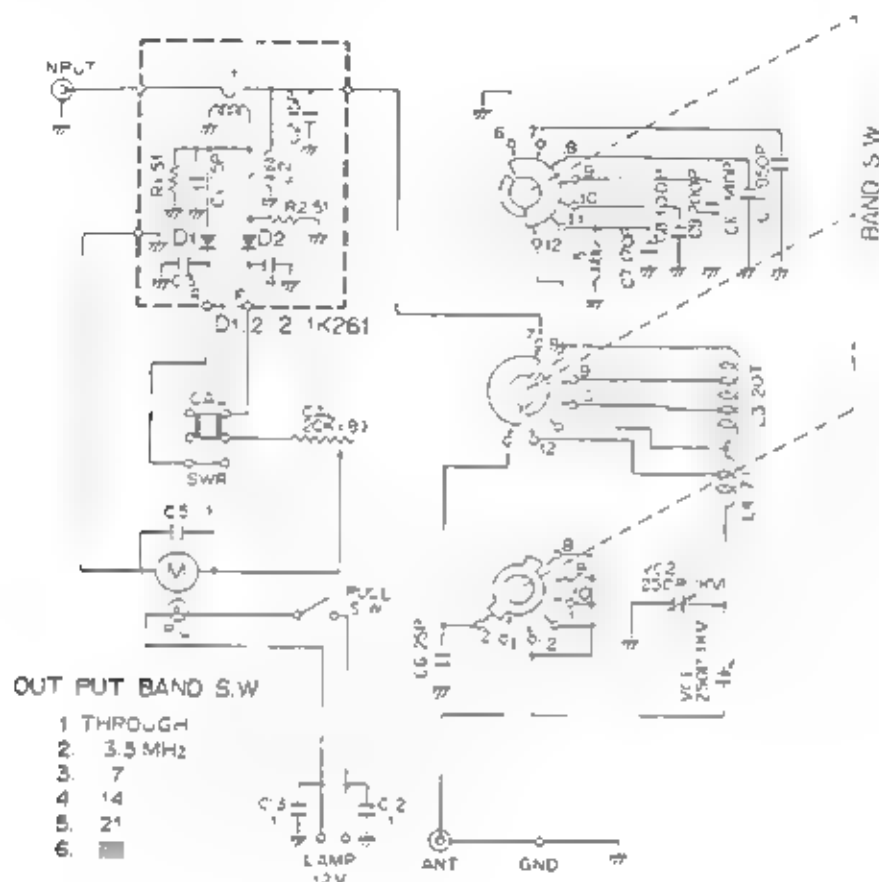
Fig 21 MB 100 installation location

Ref No.	Parts No.	Description/Specification	Re- marks
-	J51-0008-15	Snap lock	☆
-	J54 0401-14	Stay x 2	
-	J21 2633-04	Guide stopper	☆
-	J21 0401 04	Guide stopper (V)	-
-	N09-0008-04	6mm Hex Screw x 6	-
-	N14-0009-04	6mm Nut x 6	-
-	N15-1060-46	Flat washer	-
-	N 15 04 05	Flat washer x 5	-
-	N 15 04 05	Flat washer x 5	-
-	N15-0600-04	Nylon washer	☆
-	N30-4008-48	Screw	-
-	N32 3006-48	Flat head screw	-
-	N87 3006-46	Round head philips self tapping screw x 2	-
-	N88-3006-46	Flat tap right tight screw x 2	-
-	N99-0304-04	Hex head screw x 6	-
-	W01 0401 04	Hex wrench	-

AT-120 SCHEMATIC DIAGRAM/SPECIFICATIONS

NOTE The circuit and ratings may change without notice due to developments in technology.

SCHEMATIC DIAGRAM



SPECIFICATIONS

1. Antenna Coupler

Frequency range	5 amateur bands from 3.5 to 29.7 MHz
Input impedance	50Ω
Output impedance	20 to 300Ω, unbalanced.
Through power	150 W max (3.5 MHz band, 120 W)
Insertion loss	Less than 0.5 dB at optimum match.

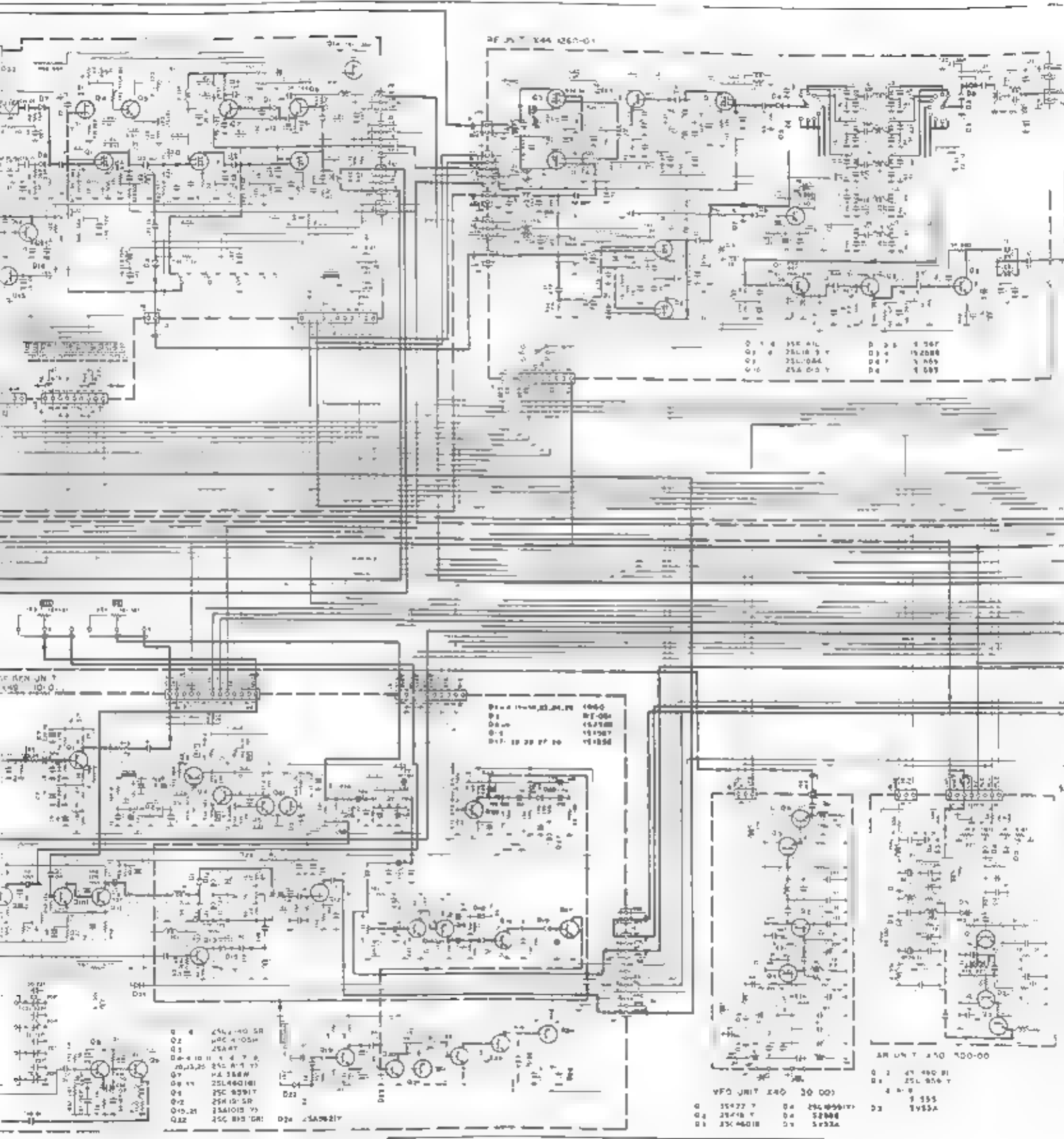
2. SWR Meter

Frequency range	3.5 to 29.7 MHz
Max power	150 W
Measurable range	1:1 to 10:1
Min. power required	2 W

3. General

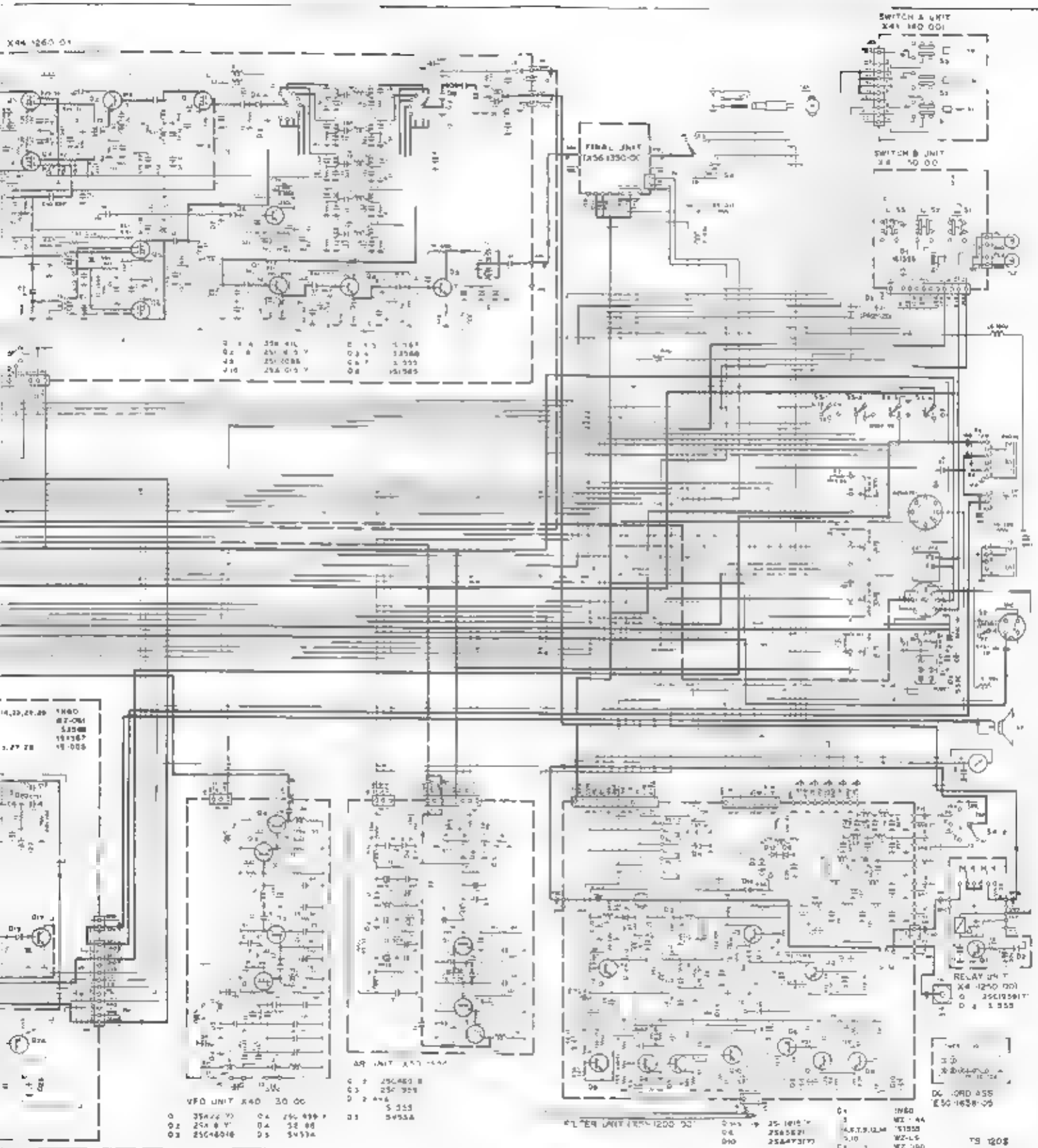
INPUT Connector	UHF type (50Ω)
ANT Connector	UHF type (50Ω)
GND	Wing nut and STUD
Dimensions	152 (6.1) W x 60 (2.375) H x 159 (6.25) D mm (inch)
Weight	1.6 kg (3.5 lbs) approx

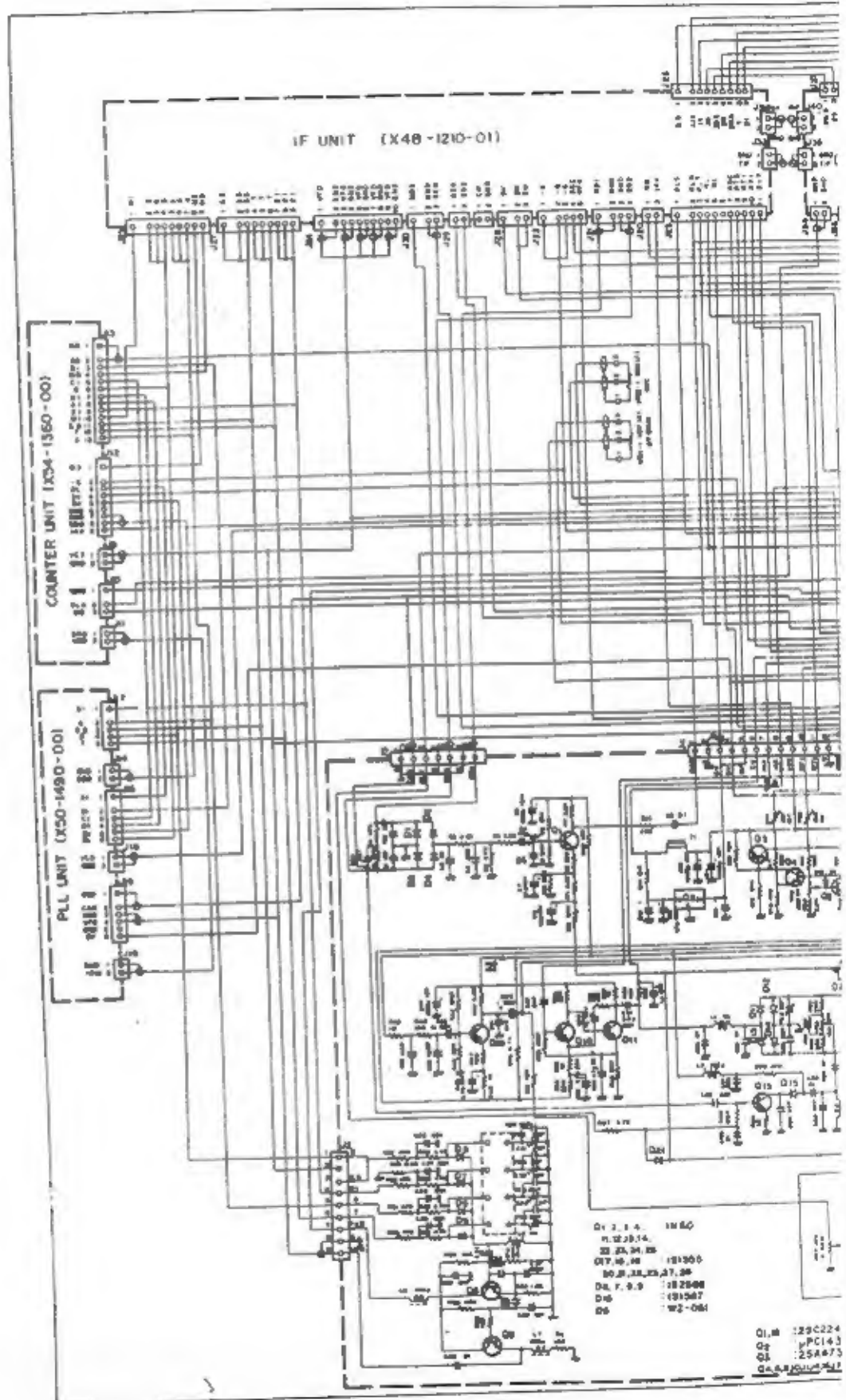
TS-120-S



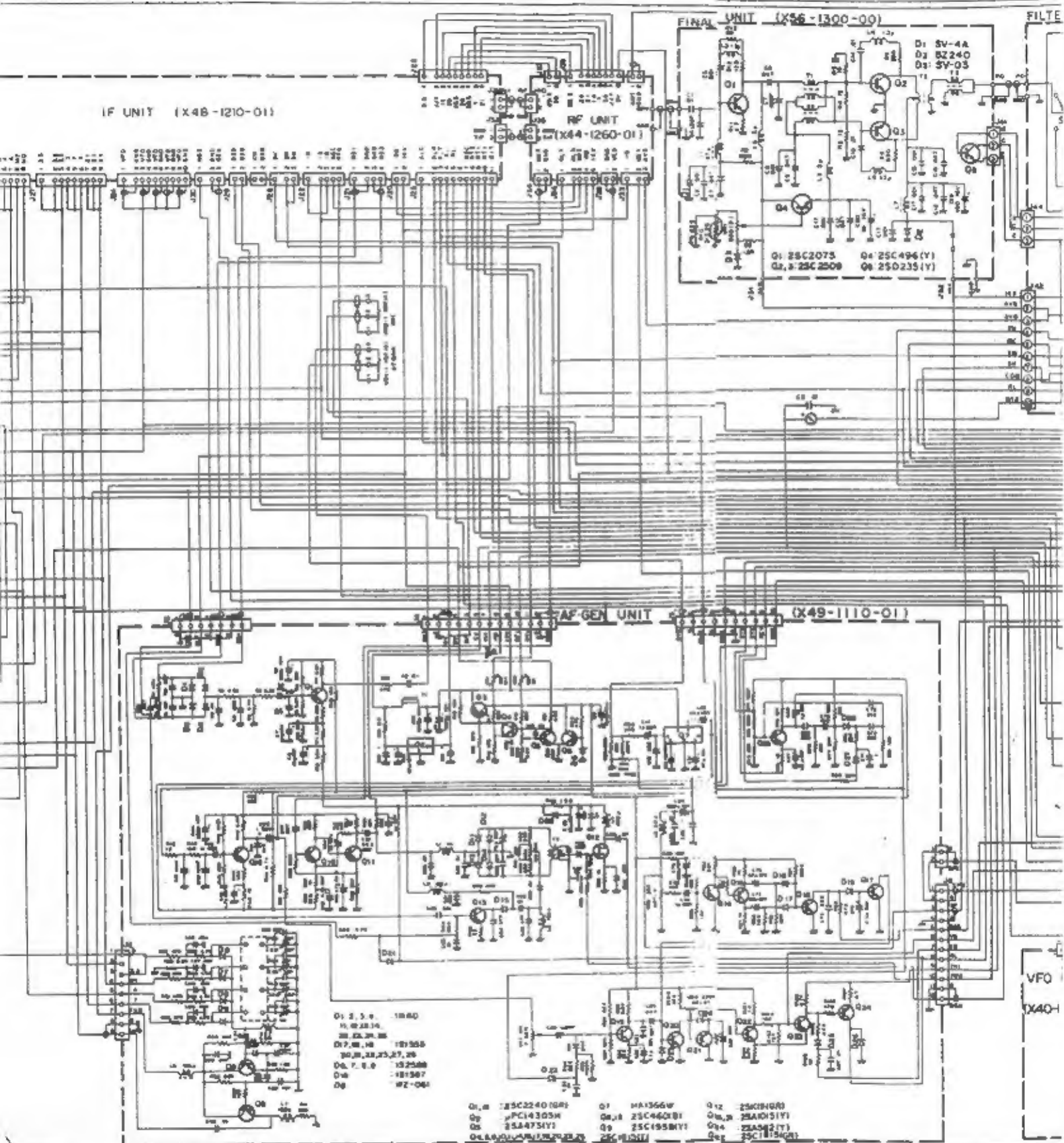
MATIC DIAGRAM

TS-120-S



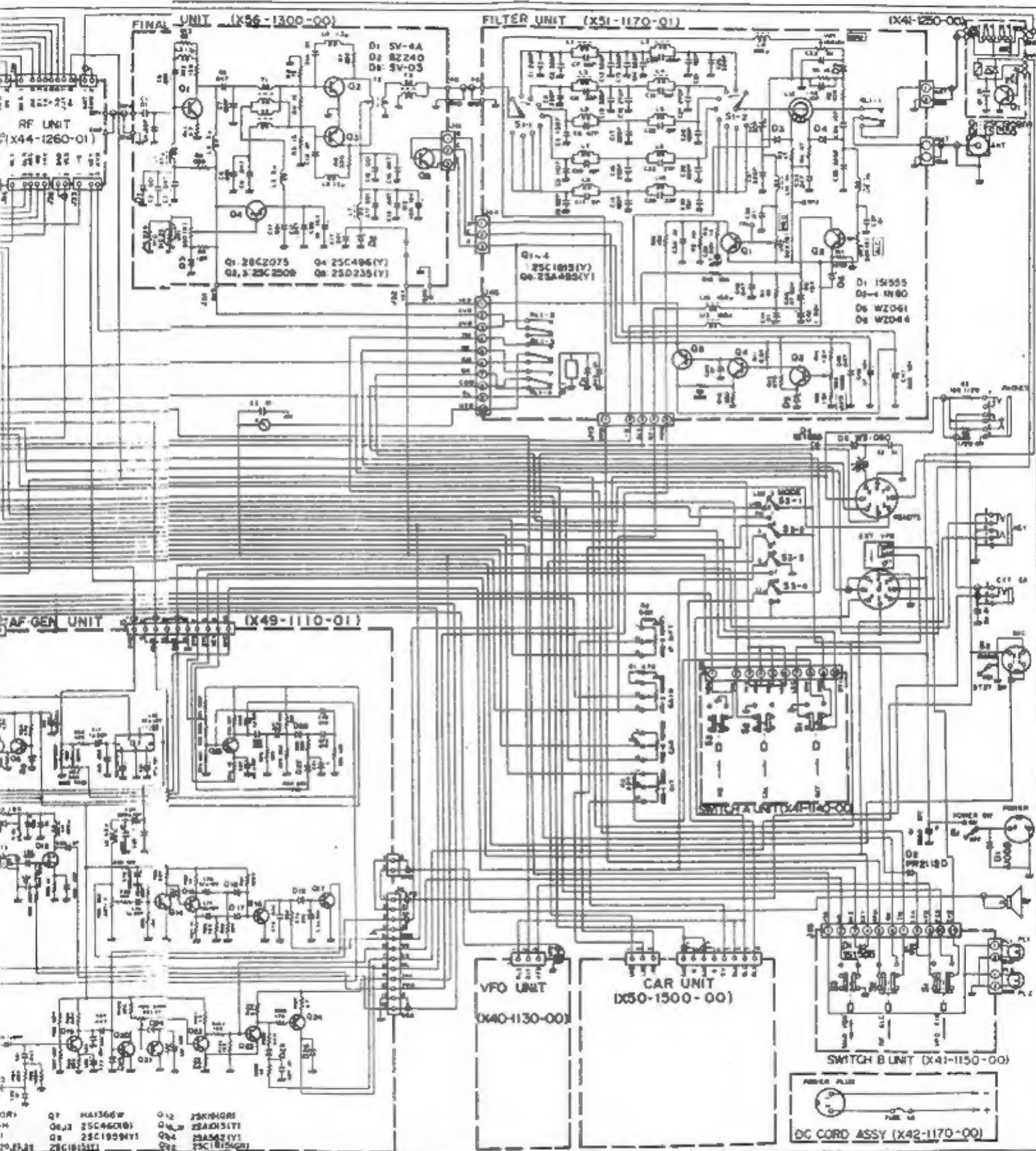


TS-120V SCHEMATIC DIAGRAM



TS-120V

120V SCHEMATIC DIAGRAM



TS-120V

A product of
TRIO-KENWOOD CORPORATION
6-17, 3-chome, Aobadai, Meguro-ku, Tokyo 153, Japan

TRIO-KENWOOD COMMUNICATIONS, INC.
1111 West Walnut Street, Compton, California 90220 U.S.A.
TRIO-KENWOOD COMMUNICATIONS, GmbH
D-6374 Steinbach TG, Industriestrasse 8A, West Germany
TRIO-KENWOOD AUSTRALIA PTY. LTD.
30 Wenting Street, Artarmon, Sydney N.S.W. Australia 2064